Pond Ecosystem Field Study MOLS

This multi-week lab involves field studies comparing ecosystem-level ecology between 2 freshwater ponds in Marshfield Outdoor Learning Sanctuary. We will be investigating a correlation between weather and pond ecosystem community diversity. The field and laboratory methods are used by scientists to monitor or decide the health of an ecosystem. In this lab, we will be monitoring following data on these ponds.

Climate: Average Weekly Temperature and Precipitation. Temperature and Precipitation will be recorded from data taken from Marshfield Experimental research station: Teacher will write on board in classroom http://www.nws.noaa.gov/view/prodsByState.php?state=WI&prodtype=climate
Pond Depth: Using a measuring stick and binoculars courtesy of the MOLS Committee. Each Field Day
Temperature of Pond: Thermometer Reading. Each Field Lab day
Soil Temperature: Thermometer Reading. Each Field Lab Day
Soil Composition-both structurally and chemically. Structure and chemical composition will be a one-time investigation. Soil samples will be taken around the pond and also from the bottom of the pond. Samples will be tested for organism composition, organic material composition, pH, nitrogen, phosphorous, and potassium levels. One Time Each Pond.
Pond water chemical composition: pH, nitrates, phosphorous, turbidity, and dissolved oxygen. One time each pond.
Pond diversity: Survey of organism diversity, specifically the type & number in and around the ponds. This includes ID of Plants, Animals or Animal Sign, Invertebrates, Vertebrates, and insects. Some organisms will be collected and identified in the classroom.

Purpose/Objectives:

- Student will become skilled at some basic field biology/ecology research techniques.
- Student will obtain a basic understanding of the interaction between biotic and the abiotic components of an ecosystem.
- Student will understand how ecosystems might be affected by naturally occurring or human-induced disturbances such as weather and water pollution from runoff.
- Student will understand basic pond ecology in central Wisconsin and be able to identify living organisms in this ecosystem.

Requirements:

- Students need to dress appropriately for the weather—including jackets, gloves, shoes/boots that can get dirty—because YOU WILL GET DIRTY AND WET (sometimes). Winter boots work. These can be kept in the greenhouse. You must have ID on them.
- Motivation to take careful dated measurements with equipment, record measurements carefully, and take proper care of the equipment. If any problems, an alternative assignment will be required
- Graphical Analysis of data for correlations, patterns, predictions.
- You will be divided into groups of 4 for this study. This is because if someone is absent, there will always be students to collect data.

Introduction.

Aquatic ecosystems range from hydrothermal vents at the bottom of the ocean, to intertidal marshes, to freshwater swamps, to high altitude lakes in the Andes. About 75 % of the earth's surface is water—both in frozen and liquid form. These ecosystems cover a tremendous range of physical and chemical conditions, yet the same kinds of organisms are commonly found in all of them - aquatic organisms. Generally, there are primary producers of two types: phytoplankton (algae) and so-called "higher" plants. Additionally, there is a host of organisms that eat plants, ranging in size from microscopic zooplankton to larger animals such as insects, amphibians, fish and other vertebrates. And of course, there are animals designed to eat these, too.

Most of the earth is occupied by aquatic ecosystems. Activities of organisms, mostly microscopic, in the oceans, exert major control over the composition of the atmosphere. They also play major roles in primary production and respiration and the associated processes of nutrient cycling worldwide.

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Although the basic structures of terrestrial and aquatic ecosystems are similar, there are several key ways that aquatic ecosystems differ. For example -

- Water is a fluid that only allows light to penetrate to certain depths. This sets the limit of photosynthesis.
- It takes more energy to locomote in water, as opposed to air. However, because of buoyancy, organisms need little structural support.
- Water has a high heat capacity which buffers environmental variation in temperature and sunlight with changing weather and season.
- Many important nutrients (P, N) and gasses (O_2, CO_2) are readily dissolved in water which makes them accessible to plants and animals.
- Compared with air, water has a greatly reduced oxygen holding capacity, which makes it difficult for submerged plants and animals to avoid suffocation unless there is considerable water adaptation.

As a result, life in aquatic ecosystems is unlike anything to which we terrestrial organisms are accustomed. Further, because of all of the factors listed, no two aquatic ecosystems are exactly alike.

The challenge of this field exercise is to describe and quantify the environmental and ecological conditions of these aquatic environments and infer:

- What are the different physical conditions, if any, between these 2 pond ecosystems?
- What correlation is there between weather and the biodiversity of the ponds? Reference your data to make this correlation In other words; what is the effect weather has on biological diversity of the pond ecosystem?

Lab Notebook: What you will hand in:

Title, Date, Group Members

Title: Pond Ecosystem Field Study MOLS Pond 1, 2
Purpose: Above
Materials: What equipment did you use? Make a list.
Methods: Identification of sampling methods that you used for what specific data.
Hypothesis: How will local weather conditions affect the pond ecosystem? Think about all living organisms that live in the ponds and around it. What do you think an increase in temperature will do? What about precipitation or lack of precipitation? How will that affect biodiversity.

Description of Area: Location, and general description of the two study sites: Shady, sunny, types of vegetation, how large, etc. Pond 1: Pond 2:

2. DATA – In Your notebook you will have many tables that need to be filled in during the study. You can cut these out and paste them in your notebook, if desired
Weather Data

Date					
Temperature					
Precipitation					

Water Data

Depth – Look at the measuring stick in the pond. Use binoculars.

Date						
Depth Pond 1						
Depth Pond 2						

Water Clarity- Lower the Secchi Disc until it is no longer visible. Measure that depth.
Other Observations – Take a sample. Record on the water transparency, color, suspended sediment, algae, etc. Keep the sample to survey microorganisms in lab.

P 1: Date						
Clarity Depth						
Other visual Observations						
P2: Date						
Clarity Depth						
Other visual Observations						

Water Nitrate, Phosphate, pH – Follow instructions
Dissolved Oxygen, Concentration – BE CAREFUL WITH THIS TEST OR IT WON'T WORK.
Take water sample; be sure there are no air bubbles. Add 2 TesTabs. Cap the tube and be sure there are no air bubbles in the sample. Invert the tube and mix until the tablets have dissolved. Wait 5 minutes. Compare the color of the sample to the dissolved Oxygen color chart. Record

P1: Date		**P2**: Date	
Nitrate		Nitrate	
Phophate		Phophate	
pH		pH	
Dissolved O2		Dissolved O2	

Water Temperature – Use thermometer.
Soil Temperature surrounding pond – Use thermometer.

Date						
P1:Water Temp						
P2: Water Temp						
P1:Soil Temp						
P2:Soil Temp						

3.Soil Data A striking feature of soil is the presence of distinct layers at various depths below ground level. These layers result from the weathering process, the accumulation and breakdown of organic matter, and the leaching of mineral matter. Your job is to attempt to describe the vertical profile of the soils and sediments around the pond and the submerged sediments. Do they vary between ponds?

Take soil core samples from the submerged soil (may have to use a shovel or get creative) and from adjacent "dry" land.

Your descriptions of your soil samples should include:

- **Soil color** (determine the soil color with the Munsell soil color chart provided)
- **Texture** (determine the texture using a texture flow diagram attached.)
- **ID organic material** that you can, including roots, fungi, and invertebrates. Use a soil test kit to determine the **pH, N, P, K** content of your soil (follow instructions in the kit.)

	Color	Texture	Organisms	Organic Matter	pH	Nitrogen	Potassium	Phosphorous
P1 Dry								
P1 Sub								
P2 Dry								
P2 Sub								

4. Biological Data

Water Sampling: Identify any microscopic organisms, and how many of the organism using light and dissection microscope.

P1 Date					
ID Organisms & # of					
P2 Date					
ID Organisms & # of					

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Net Sampling: For deeper samples. Identify any organism and how many using dissection and light microscope. (Fish, tadpoles, frogs, etc

P1 Date				
ID Organisms and # of				
P2 Date				
ID Organisms and # of				

Pit Trap for insects: Dig pit trap (plastic bottle) into sites around pond, making sure top of trap is level with ground. In bottom of trap, place some alcohol (acts as a preservative). Check Bi-weekly. Identify organism and number of. We will have 1 per pond. Checked/Recorded every Field day. We will rotate responsibility.

P1 Date					
ID Organisms and # of					
P2 Date					
ID Organisms and # of					

Flat Boards on ground: Place one board near each pond/group.ID our class on it. Do not touch other classes. Check every field day. ID organisms and # of. We will have one on each pond/class.

P1 Date					
ID Organisms and # of					
P2 Date					
ID Organisms and # of					

Plant diversity within 1.5 meters of shoreline. Identify and quantify plants surrounding ponds. collect for ID or use Field Guides. Must ID at least 5 Plants/Trees per Pond. Type & Distinguishing characteristics or drawing in Lab notebook.

P1:

1.
2.
3.
4.
5.

P2:

1.
2.
3.
4.
5.

Other Biological life. Look for amphibians, mammals, birds. This could also just be sign such as tracks, scat, etc. Recorded every field day. Keep a list (dated).

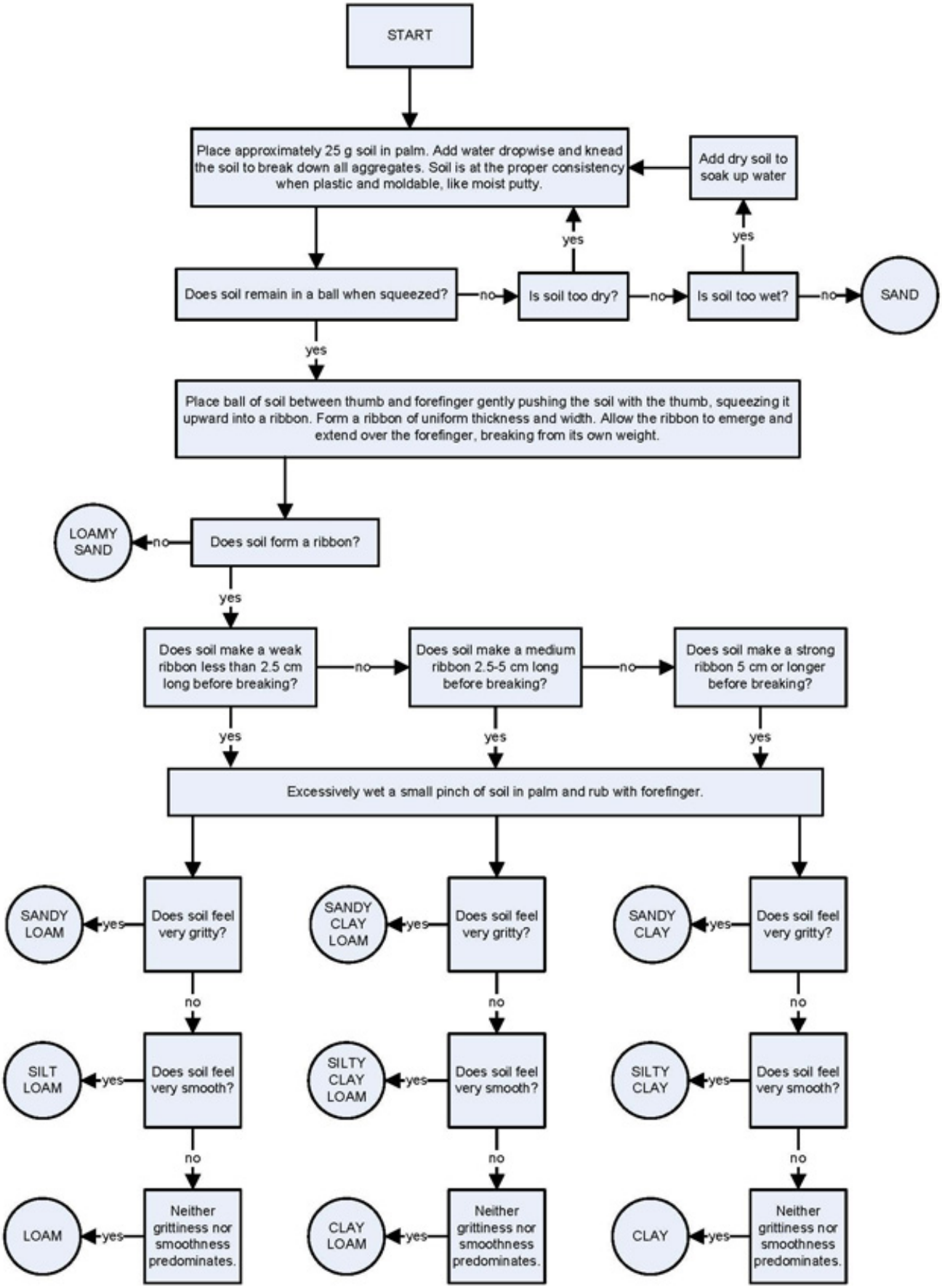
P1 Date						
ID Organisms and # of						
P2 Date						
ID Organisms and # of						

5. Graphical Analysis of Data: Use Graphing Paper or Excel. Graphing is required for

- Weather Data: Temp Vs Date & Precipitation VS Date on same color coded graphs
- Soil Temp: Temp Vs Date, 2 Color Coded Graphs representing each pond.
- Pond Micro Organisms: # of Kind vs Date: A graph for each pond, may put on 1 graph if works.
- Pit Trap Insects: # of Kind vs Date: A graph for each pond. May put on 1 graph if works.
- Board Habitat: # of Kind vs Date: A graph for each pond. May put on 1 graph if works.

6. Conclusion:

1. Statement of Results:
   - What are the different physical conditions, if any, between these 2 pond ecosystems?
   - What correlation is there between weather and the biodiversity of the ponds? Reference your data to make this correlation In other words What is the effect weather has on biological diversity of the pond ecosystem?
2. Discussion of Theory
   How might the observed physical and biological differences interact to determine organism diversity?
3. Source of Error
4. Reflection


START
Place approximately 25 g soil in palm. Add water dropwise and knead the soil to break down all aggregates. Soil is at the proper consistency when plastic and moldable, like moist putty.
Add dry soil to soak up water
yes
yes
Does soil remain in a ball when squeezed?
no
Is soil too dry?
no
Is soil too wet?
no
SAND
yes
Place ball of soil between thumb and forefinger gently pushing the soil with the thumb, squeezing it upward into a ribbon. Form a ribbon of uniform thickness and width. Allow the ribbon to emerge and extend over the forefinger, breaking from its own weight.
LOAMY SAND
no
Does soil form a ribbon?
yes
Does soil make a weak ribbon less than 2.5 cm long before breaking?
no
Does soil make a medium ribbon 2.5-5 cm long before breaking?
no
Does soil make a strong ribbon 5 cm or longer before breaking?
yes
yes
yes
Excessively wet a small pinch of soil in palm and rub with forefinger.
SANDY LOAM
yes
Does soil feel very gritty?
SANDY CLAY LOAM
yes
Does soil feel very gritty?
SANDY CLAY
yes
Does soil feel very gritty?
no
no
no
SILT LOAM
yes
Does soil feel very smooth?
SILTY CLAY LOAM
yes
Does soil feel very smooth?
SILTY CLAY
yes
Does soil feel very smooth?
no
no
no
LOAM
yes
Neither grittiness nor smoothness predominates.
CLAY LOAM
yes
Neither grittiness nor smoothness predominates.
CLAY
yes
Neither grittiness nor smoothness predominates.