

Appendix A. Science and You Survey

Question # in SPSS	Scale	Original text & question # in SurveyMonkey
	<u>Confidence</u> with science	
Q1		1(1) "I am good at science"
Q2		1(2) "I enjoy studying science"
Q3		1(3) "I feel at ease with science"
Q7		1(7) "I would like to be a scientist"
Q8		1(8) "Science is not interesting to me"
Q14a		"How easy or difficult do you find these courses?" 2(a) Biology lecture
Q14b		2(b) Biology lab
Q14c		2(c) Chemistry lecture
Q14d		2(d) Chemistry lab
Q14e		2(e) Writing
Q15a		"What do you expect your grade to be in each of the following courses?" 3(a) Chemistry - Grade
Q15b		3(b) Biology - Grade
Q15c		3(c) Writing - Grade
Q6		1(6) "I'm afraid I might fail some science courses"
	<u>Motivation</u> toward science	
Q5		1(5) "Even if the work in science is hard, I can learn it"
Q10		1(10) "Some of the ideas in science are just too hard for me to understand"
Q11		1(11) "Science helps me to improve my ability to think and solve problems"
Q12		1(12) "Studying science helps me understand world problems"
Q13		1(13) "I am interested in taking additional courses in science"
Q16		4(1) "The subject of science has little relation to what I do outside of school"
Q18		4(3) "I may not make great discoveries, but working in science would be fun"
Q19		4(4) "Scientists have to study too much"
Q20		4(5) "Scientists do not have enough time for their families or for fun"

	<u>Enjoyment</u> toward science	
Q4		1(4) “I don’t like doing science labs”
Q9		1(9) “I often feel bored in science classes”
Q17		4(2) “I am interested in discussing science with friends or family”
	<u>The value of</u> science	
Q21		4(6) “Science is important for society”
Q22		4(7) “Anything we need to know can be found through science”
Q23		4(8) “A major purpose of science is to help people live better”
Q24		4(9) “Thanks to science, there will be greater opportunities for future generations”
Q25		4(10) “Science can solve nearly all problems”
Q26		4(11) “Many scientific conclusions are simply not true”
Q27		4(12) “Science is the cause of environmental problems”
Q28		4(13) “The benefits of science are greater than the harmful effects it could have”
	<u>Demographics</u>	
Q29		5. During high school, how active were you with science-related activities (e.g., science fair projects, science camps, science clubs, etc.)?
Q30		6. In the last year, how frequently did you visit science museums, science and discovery centers, or state or national Parks?
Q31		7. In the last year, how often did you read about or watch science-related topics on mass media (e.g., TV, newspapers, magazines, books, etc.)?
Q32		8. How many people, if any, in the household where you grew up have/had college degrees in science?
Q33		9. What is the highest level of education in the household where you grew up?
Q34		10. Are you currently employed?
Q35		11. How many hours per week do you work at your job?
Q36		12. Are you engaged in extracurricular activities (e.g., non-academic, sports, clubs, student government, etc.)?
Q37		13. How many hours per week do you commit to extracurricular activities at college?

Q38		14. Total credit hours you are taking this semester:
Q39		15. Please indicate your age.

Student entry interview protocol

1. What interests you most about science?
2. Describe your high school science experiences.
3. Describe a memorable science lesson from high school.
4. Do you feel well prepared for science courses in higher education?
5. How were you evaluated in high school science courses?
6. Did you collaborate with other students during science classes?
7. What technology do you feel comfortable using in an academic setting?
8. What influenced you to major in the sciences?
9. What do you believe are important components of science courses?
10. What is most challenging about science courses?
11. What expectations do you have for Project Synergy?
12. What careers would you like to explore?

Student exit interview protocol

1. What skills did you gain this year?
2. What science topics did you find most interesting?
3. What laboratory practices were most useful this year?
4. Beyond learning new skills, did Project Synergy impact you in other ways?
5. Describe a memorable academic experience from this year.
6. In what ways did you collaborate with your peers?
7. In what ways did you use technology?
8. What aspects of the school year were most challenging for you?
9. Did your past science experiences prepare you for this year?
10. Do you feel well prepared to take upper-level science courses?
11. Did Project Synapse meet your expectations?
12. What were some strengths of Project Synergy?
13. What were some weaknesses of Project Synergy?
14. Do you have any suggestions for improving the Project Synergy program in the future?
15. What are your plans for the future?

Source. Patton, M. Q. (1990). *Qualitative evaluation and research methods*. SAGE.

Appendix B. Restoration of Woodland Herbs in Post-Agricultural Forests II: Field Testing of Hypotheses and Sampling

Introduction

Last week, we observed the apparent slow recovery of forest understory herbaceous communities in successional, post-agricultural woodlands. You had the opportunity to investigate a paired set of forest stands—one a remnant, primary woodland, and the other an adjacent post-agricultural, secondary woodland. During the past week, you developed predicted, focused, and testable hypotheses regarding several factors that you thought might limit the distribution of woodland herbs in post-agricultural woodlands, and you have proposed methodologies for testing them.

This week, we will continue our investigation into this phenomenon of limited herbaceous plant distribution in post-agricultural woodlands. This week's objectives are the following:

1. Collect field data to test a small subset of the hypotheses that we proposed last week.
2. Continue a long-term, applied study to assess the feasibility of restoring woodland herb communities through direct seeding.

Study sites

This week, we will visit one of two forest stands located in the “Guppy Farm.” Schematic diagrams of the two sites are provided at the end of this unit. Each site consists of a paired primary woodland and adjacent secondary, post-agricultural woodland.

Furthermore, a system of 10 x 10 meter permanent study plots has been established in each secondary woodlot on a grid with axes labeled A-K and 0-50(100). Each plot within the grid system can therefore be identified through this coordinate system (e.g., “B30” or “F20,” see maps). The 0-50(100) axis will always represent the boundary between the primary and secondary woodlot.

Field measurements—The dependent variables

You will collect field data and/or samples to test hypotheses related to the following response variables.

Soil acidity: All organisms have a “range of physiological tolerance” for a variety of environmental conditions, including acidity. Acidity is measured in units of pH, a logarithmic environmental scale that indicates the concentration of hydrogen ions. For plants, soil acidity levels usually control nutrient availability since different mineral nutrients are soluble at different levels of acidity. Alternatively, acidity may be an indirect measure of the amount of nutrients available in the soil to begin with (due to differences in the substrate from which the soils developed or to the historic influences that may have led to the loss of nutrients). We will collect soils for laboratory analysis of pH in order to determine whether differences exist between the primary and secondary woodlands.

Depth of forest floor: Many plants are rooted within the organic-rich forest floor soil horizon and therefore acquire nutrients and water from that soil layer. The term “organic” refers to carbon content, not the stuff in the grocery store. Organics reduce the soil density (thereby making it easier for the roots to penetrate the soil) and serve to chemically bond nutrient ions, making them more bio-available. We will measure forest floor depth to determine whether differences exist between the primary and secondary woodlands that may be meaningful for plant nutrient acquisition.

Soil organic content: Depth of forest floor is not the only way to measure amount of organic matter in soils. Back in the lab, we will determine the soil’s organic content by combusting the soils and measuring the loss of mass. These data yields information regarding both the carbon content and mineral content of the soil.

Soil moisture content: Soil moisture content is indicative of both the amount of precipitation a site has received as well as the type of soil that is present. Some soils hold onto moisture better than others (e.g., clay and silt vs. sand). Using the moisture content, we might be able to determine soil variety and the type of plant growth that can be supported by that soil.

Microsite heterogeneity: Many plants may also require exact habitat requirements for their growth. There may be specific “microsites” (measured on the scale of centimeters) within a larger forest stand (measured on the scale of hectares) that are necessary for the growth and reproduction of some plant species. We will measure the different types (heterogeneity) of microsites within the primary and secondary woodlands to determine whether differences exist that may account for the limited distribution of woodland herbs.

Light intensity: The existence of a dense forest canopy may obscure the light required by plants growing on the forest floor, and therefore limit the ability of those plants to obtain enough energy for growth and reproduction of some plant species. We will measure light intensity within the primary and secondary woodlands to determine whether differences exist that may account for the limited distribution of woodland herbs.

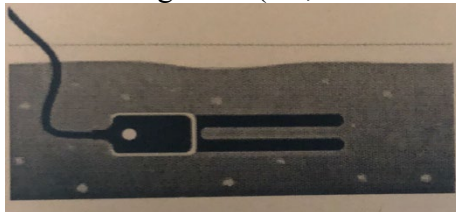
Dispersal: Some plants may be quite capable of germinating and growing within the range of environmental conditions in secondary woodlands, but simply do not possess the capacity to disperse quickly into those sites. We will test for dispersal limitation of several plant species through a direct sowing experiment in the secondary woodlands. We will not obtain any experimental data from this trial, but will rather initiate the experiment that will be monitored and reported on by future classes.

Field procedures

Understand that for some of the variables you will not be conducting a true test of whether those variables are actually controlling plant distributions. For instance, we will not test whether soil pH, forest floor depth, microsite heterogeneity, and light intensity differ between the primary and secondary woodlands. If the factors do not differ, then we can rule them out as possible factors limiting the distributions of these forest herb species. However, if they do differ, we still do not know whether these differences

actually are accounting for the observed limitations in plant distributions. To know that, we would need to establish experiments in which we germinate and/or grow the plants under strictly controlled conditions.

- Students will work in groups of 2s or 3s. Each student group will be assigned a 10 x 10 m (100 m²) permanent plot in the secondary woodland, and work at a random location within the primary woodland. Each group should conduct the following procedures in the field:
 - **Soil acidity:** At a random location within the 100m² plot, brush away the leaf litter, and extract a 10 x 10 cm sample of the forest floor and upper 5 cm of mineral soil. You will use a hand-saw to cleanly and precisely cut away and remove the soil. Place the sample in a collection bag to be returned to ESF. **LABEL THE BAG WITH YOUR INITIALS, SITE, PLOT ID, AND STAND (1 OR 2 DEGREES).** We will use the soil sample above to test soil pH in the laboratory.
 - **Depth of forest floor:** Use the sidewall of the soil sample you extracted to measure the depth (cm) of the forest floor layer with a ruler.
 - **Soil organic content:** The soils extracted for pH measurements will be used to determine loss on ignition.
 - **In-field moisture measurements:** Obtain a Vernier meter with moisture probe. There will be 1-2 at the site. Dig up the soil until you have a small trench large enough for the probe to fit in sideways (see figure) and insert the probe into the trench and backfill with soil. Press down lightly. Wait until the moisture value stabilizes, then record the value in your notebook and click 'keep' on the Vernier LabQuest, then remove the probe from the soil, but DO NOT pull by the cable.
 - **Microsite heterogeneity:** Randomly select one of the 10-m long borders of your plot. Use the tape measure to establish a horizontal line 100cm above the ground (two students will have to hold either end of the tape measure). Pull the tape taught to that there is no slack in it. At 1-m intervals measure and record the distance (cm) from the tape to the ground surface, Record the type of substrate at the point where your meter stick touches the ground (i.e., hardwood litter, conifer litter, exposed soil, rock).



- **Light intensity:** You will be instructed on the use of a light meter. Use the light meter to record the photon flux density ($\mu \text{ mol/ m}^2/\text{ sec}$) directly over the ID pin of your plot.
- **Dispersal (in secondary woodland only):** Your instructor will provide each group with one or several packets of seed that were collected earlier in the year. Toward the center of the plot, brush back the leaf litter and scarify the mineral soil. Place each of the seeds that have been provided a

few centimeters apart on the forest floor. Replace the leaf litter. If you have more than one type of seed, sow the different species in slightly different locations, but still toward the center of the plot. We will not be able to follow up with germination success. Future classes will investigate establishment success on these experimental plots.

Field data sheet—Secondary woodland

Study Site: E or W

Names of group members:

Secondary Woodland Plot ID: _____

1. Extract 10x10x5 cm sample - place in **labeled** bag (make sure to be labeled **secondary**).
2. Record soil pH (in laboratory): _____ pH units.
3. Measure and record depth of forest at sidewall of your soil sample.
_____ cm
4. Record the height (cm) of the tape above the ground surface and substrate type where the meter stick intercepts the ground (**hardwood litter, conifer litter, exposed soil, log (>5cm), other (stick <5 cm, root, moss, rock)** at ten 1-m intervals along plot border. **DO NOT LET THE TAPE MEASURE SAG IN THE MIDDLE - HOLD TIGHT.**

Sample Location (m)	height of tape (cm)
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

5. Photon Flux Density (μ mol/ m²/ sec) directly over ID pin

6. Soil moisture (percent) _____

7. Soil Temperature (degrees Celsius) _____

Field data sheet—Primary woodland

Study Site: Skaneateles E or W

Names of group members:

Within a random location in the primary woodland, do the following:

1. Extract 10x10x5cm sample - place in **labeled** bag (make sure labeled **primary**).
2. Record soil pH (in laboratory): _____ pH units.
3. Measure and record depth of forest floor at sidewall of your soil sample.
_____ cm.
4. Record the height (cm) of the tape above the ground surface and substrate type where the meter stick intercepts the ground (**hardwood litter, conifer litter, exposed soil, log (>5cm), other (stick <5 cm, root, moss, rock)** at ten 1-m intervals along plot border. **DO NOT LET THE TAPE MEASURE SAG IN THE MIDDLE - HOLD TIGHT.**

Sample Location (m)	height of tape (cm)
substrate type	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

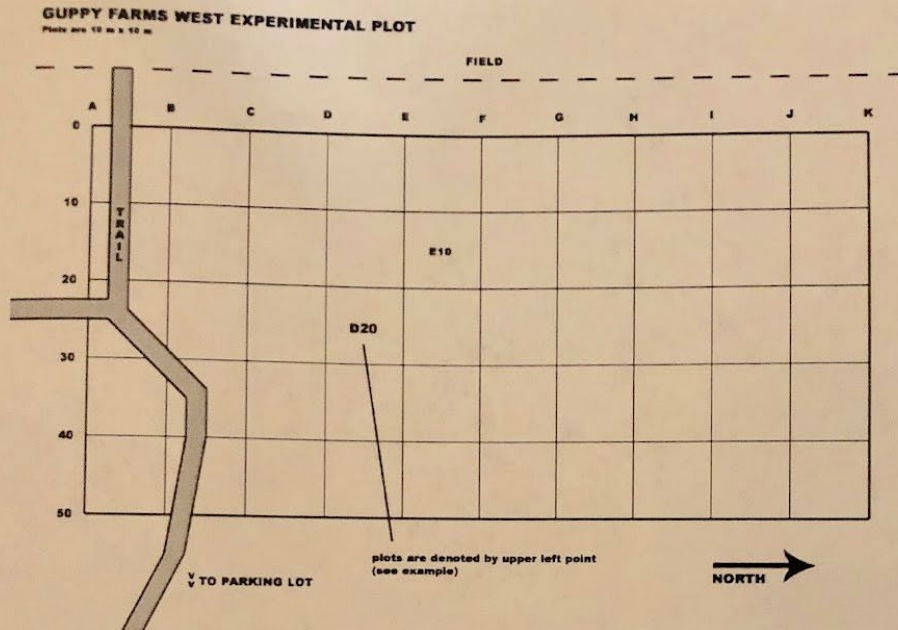
5. Photon Flux Density (μ mol/ m²/ sec) directly over ID pin

6. Soil moisture (percent) _____

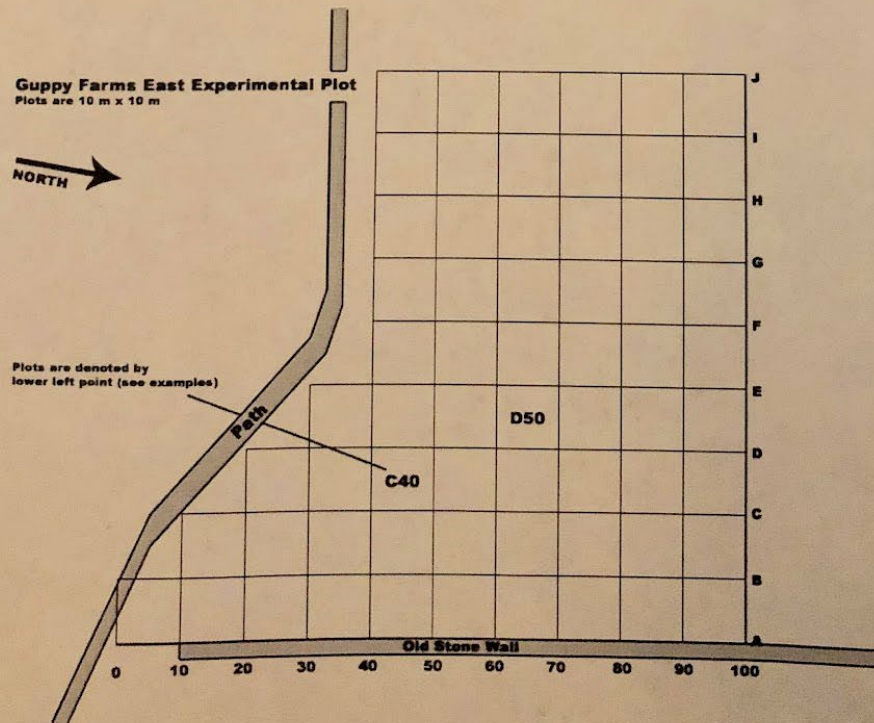
7. Soil Temperature (degrees Celsius) _____

Schematic diagrams of experimental restoration sites at Guppy Falls Conservation Area.

A



B



Lab 2.1 Pre-Lab Assignment: Due Tuesday, September 3.

- Answers to the following questions must be completed in your lab notebook. Tear out the yellow “copy” [age and turn this in to your instructor.

1. Identify the names of the following ions: H^+ , NO_3^- , Cl^- , PO_4^{3-}
2. Define the term pH.
3. What size hole should be made for the field-based moisture measurement?
4. How will you know when to record (‘keep’) the moisture measurements in the field?
5. On what date and time will you attend the field trip?

Be prepared to answer questions about this experiment.

2.2 Restoration of Woodland Herbs in Post-Agricultural Forests III: Soil Sample Analysis

Experimental procedures adapted from: *Laboratory Manual for Soil and Plant Tissue Analysis*, D. H Bickelhaupt and E.H. White, SUNY ESF, 1982.

Getting started

Lab will meet in 130 Jahn. Goggles must be worn at all times. Survey the materials in the lab to make sure you know where everything is located.

I. Observations

A portion of your soil samples from the primary and secondary woodlots have been removed from the bags and placed in a hood to air-dry. Obtain your original “wet” soil sample. In your notebook, describe the soil sample. Mix the soil well and look at aspects of color, grain size, texture, and moisture. Be sure to have a record of the soil’s original location and sampling technique. Sandy soil tends to flow freely and appear granular in nature whereas clay-like soil will clump together when pressed. Record a description and potential soil identity based on each of these features. For example, “The soil appears light brown in color with a fine sandy texture. It is relatively dry and does not clump. These observations indicate that this soil likely contains little organic matter and has a low moisture content.”

II. Determining soil moisture content - in lab

Soil moisture content is indicative of both the amount of precipitation a site has received as well as the type of soil that is present. Some soils hold onto moisture better than others (e.g., clay and silt vs. sand) and the only way to determine the moisture content of the soil is to compare the air-dried soil to the soil dried by high-temperature. Examine your **air-dried** soil sample and compare it to the native “wet” soil in the sealed bag. Do you expect the soil to have a high or low moisture content? Record a testable hypothesis regarding the composition of the soil.

Working in groups of **two** , establish a testing protocol for reporting the following quantitative pieces of data that will verify or reject your hypothesis. These data should include: the initial mass of the soil (wet), final mass of the soil (dry), mass loss on dehydration, and total percent moisture content. You have the following materials available to you:

- Drying oven set @ 120°C
- Electronic balance
- Weigh dishes
- All materials in your lab drawer

General procedure

You should use three (3) 10 g samples of soil for your analyses. The experiment is run in triplicate to decrease error. The mass of each sample does not need to be 10.000 g, but the value must be recorded exactly. You will need to use a lab balance, so review the section on *Using a Balance* in the Common Lab Procedures section in this manual (Appendix A). When recording mass, use the maximum number of significant digits available on the balance. Measure the soil sample into a 50ml pre-massed (i.e., tare mass), pre-labeled beaker before placing in the oven. **Be sure you label the beaker before recording the mass and adding the soil.** Place the 3 beakers in the drying oven. You will need to wait until the soil sample is dry, so determine a procedure to knowing when your sample has reached dryness. Review your step-by-step procedure with an instructor before proceeding. Clearly record all notes in your laboratory notebook. These will include: mass values for soil samples and beakers, procedure for drying, method for determining final dryness, time used for drying, and other details necessary for someone to repeat your procedure and interpret the results.

Continue on to **Part III** while your soil heats/cools. Once the sample is dry and calculations are complete, compare this value to the one obtained in the field using the moisture meter for the SAME soil sample location. Data are posted on Blackboard under: **ESF.296.2.Merged > Laboratories > Herb Restoration.**

Safety note: Use extreme care when working near the drying oven. Samples will be hot when removed, so use a heat glove or tongs to remove your sample. Let cool for 5 minutes (*at a minimum*) before handling and placing back on the balance.

Percent moisture can be determined using the following equation:

$$\text{sample \% moisture} = \left(\frac{|\text{wet mass} - \text{dry mass}|}{\text{wet mass}} \right) \times 100$$

The average % moisture is calculated as follows:

$$\text{Average \% moisture} = \left(\frac{\text{sample}_1 + \text{sample}_2 \dots + \text{sample}_n}{n \text{ samples}} \right)$$

III. In-lab soil acidity - measurement of pH

Soil acidity is one of the most important factors affecting plant growth. Some plants thrive in highly acidic soils while others grow best in basic soils. Soil acidity levels, measured in units of pH, can be indicative of the types of plants that would grow in that area. All of the soil gathered for this laboratory was obtained from a woodland forest.

There are a few qualitative measures of soil pH:

- Strongly acidic soils have very distinct, visible soil horizons
- Flora such as Scots pine, rhododendron, birch, and heather prefer acidic soil
- Flora such as ash, honeysuckle, and lilac prefer basic soils
- Soils with large organic content (i.e., compost, humus) tend to be acidic
- Soils in the Northeast tend to be slightly acidic

Measurement of soil acidity is often reported in units of pH, or hydrogen-ion concentration, H⁺. A pH value of <7 indicates something is acidic, a pH > 7 indicates basic, and a pH =7 is considered neutral. Typical pH ranges for soil are from 4-8.5. By measuring a soil's pH, you can determine the concentration of acid present in the sample and extrapolate some information regarding nutrient availability. You have the following materials available to you:

- pH meter and probe
- Electronic balance
- Weigh dishes
- Filter paper
- All materials in your lab drawer

General procedure

To determine soil pH, you will use a Vernier LabQuest with a pH probe that quickly measures and reports a value. You will need to first filter your sample using a *gravity filter*, so read the section on gravity filtration in the Common Lab Procedures section in this manual. You will need to obtain ~20g of **air-dried** soil and mix thoroughly with 200 mL of deionized water in a beaker (*yes, you are making mud!*), then filter it using gravity filtration. Be sure to record the exact mass of soil used in the measurement. Get out as much of the soil as possible using a spatula, but do not add more water. After the soil is

filtered into an Erlenmeyer flask, use the pH meter to obtain the pH of the solution. We have already calibrated the pH meters for you before the lab began.

Using the pH meter and probe

Bring the soil filtrate over to the pH station. Remove the pH probe from the buffer solution, rinse it with deionized (DI) water and blot dry with a large lab wipe. Place the probe into your solution and wait for the pH value to stabilize (~20 seconds) and record the value in your notebook. Remove the probe from the solution rinse again with DI water, blot dry, and place back into the buffer solution for the next user.

After obtaining the pH, **save the filtrate** for part IV (ion concentrations) below. Follow the **Cleanup notes below** on discarding the soil and filter paper.

IV. In-lab ion concentration measurement - calcium, chloride, and nitrate

Ion concentration yields specific information about the nutrients present in the soil. You will test for inorganic nutrients that can improve or retard growth, depending on the ion and the specific concentration of each ion. You will test for the following ions: calcium (Ca^{2+}), chloride (Cl^-), and nitrate (NO_3^-). You will need to use the literature to determine the importance of these ions in soil for plant growth.

Ion concentrations will be measured using an ion-selective electrode (ISE) for each ion of interest. The electrode is a chemical probe that is sensitive a specific ion, which is why we have three different probes; one for each ion. The probes are connected to the common Vernier LabQuest that automatically outputs concentration data in units of mg/L (ppm).

General directions for ISE use

1. An instructor will calibrate each ion-selective electrode (ISE) before you need it.
2. The ISE should be soaking in the appropriate High Standard (*this is similar to the buffer solution for pH*). Make sure that it is not resting on the bottom of the container, and that the small white reference contacts are immersed.

Follow the similar procedures to making the pH measurements:

3. Rinse off the end of the ISE, and blot it dry with a lab wipe.
4. Insert the tip of the ISE into the sample to be tested. Important: Make sure the ISE is not resting on the bottom of the container, and that the small white reference contacts are immersed. Make sure no air bubbles are trapped below the ISE.

Note: Do not completely submerge the sensor. The handle is not waterproof.

5. Hold the ISE still for **60 seconds** and record the displayed reading.
6. Rinse the ISE with distilled water and gently blot it dry.

7. Return the ISE to the High Standard bottle.

After obtaining the ion concentrations, **save the filtrate** for part V (TDS) below.

V. Total dissolved solids (TDS)

Total dissolved solids refer to the total concentration of compounds dissolved in water. This does not refer to the suspended solids, which is another type of measurement. Since your soil has been filtered, all the suspended solids have been removed and only the dissolved solids remain. So how do we determine the quantity of dissolved solids? There are a few methods: 1) evaporating the water, 2) using a conductivity probe, or 3) measuring the solution density.

- Evaporating the water is simple and gives us information about salts that might be dissolved as well as some organic compounds like proteins.
- A conductivity probe **only** tells us about the concentration of salts that are ionized and able to conduct electricity in solution.
- A solution's density tells us about the mass of solution per a certain volume. Pure water has a fixed density of 1.00 g/mL, but water that has solids dissolved in it will have a heavier density.

You will determine the total dissolved solids by both evaporating water and measuring the density of solution.

Measuring solution density

1. Obtain a 50-mL graduated cylinder and record its tare mass in your notebook.
2. Fill the graduated cylinder with 50 mL of filtrate from the pH measurement above.
3. Record the mass of the cylinder with the filtrate
4. Calculate the density of solution in units of g/mL.

Evaporation to determine TDS

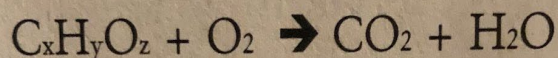
1. Pour the 50 mL of filtrate from the graduated cylinder into a tared 400 mL beaker. Be sure the beaker is clean and dry before you begin.
2. Place the beaker on a hot plate and heat to boiling. You can safely turn the temperature dial to between 6-7. If the hotplate has digital temperature values, you must

turn the temperature near 200-250°C (100°C only refers to the temperature of the top of the hotplate).

3. Wait for the solution to completely boil away, then immediately turn off the hotplate, remove the beaker, and let it cool in the hood.
4. Once cool, record the mass of the beaker plus residue. This residue is the resulting total solids that were dissolved in the water.

VI. Soil organic content - combustion analysis

How much of soil is organic vs. inorganic? Organic materials all contain carbon. These are things like decayed and living plant and animal matter in the soil. Because organic substances contain carbon, they burn, or combust, at high temperatures.



Equation 1. General *unbalanced* combustion reaction for the formation of carbon dioxide and water from an organic compound.

Inorganic matter contains metals and salts that do not contain carbon or combust. These are things like silicon dioxide (sand, SiO_2), potassium salts (e.g., potash, K_2O), and phosphate salts (e.g., sodium phosphate, Na_3PO_4). Some nitrogen-containing compounds will also burn away.

You will now determine the percentage of inorganic and organic material in a dried soil sample. You will use a high-temperature furnace to burn away all of the combustible materials, leaving behind only inorganic residue, known as ash. Working in groups of **two**, establish a protocol for reporting the following pieces of data: the initial mass of the soil, final mass of the soil, mass loss, percentage organic, and percentage inorganic content. You have the following materials available to you:

- High temperature furnace set @ 600°C
- Ceramic crucibles or well plates
- Electronic balance
- Weigh dishes
- All materials in your lab drawer

General procedure

Use the pre-dried soil from **Part II** (*no more than 10g*) for the combustion analysis. Clearly label your sample with your initials and lab time and submit them for testing. Combustion will require overnight heating, so you will need to come back during the

next lab session to determine the residual mass of the soil sample. Samples will be located outside of 135 Jahn (inside 130 Jahn).

Calculations to determine percent organic and inorganic content:

$$\begin{aligned} \text{mass of inorganic} + \text{mass of organic} &= 100 \% \\ \% \text{ organic} &= \left(\frac{|\text{initial mass} - \text{final mass}|}{\text{initial mass}} \right) \times 100 \end{aligned}$$

Clean-up

Before leaving lab:

- Clean the balance and area around the balance.
- Wash all glassware with soap and water. Do a final rinse with deionized water.
- Place the filter paper in the trash. Place soil in the designated “Used soil” container for returning to nature.
- Return all other materials to the appropriate location

Lab 2.2 Pre-Lab Assignment

Complete these questions *before* coming to lab. Answers must be completed in your lab notebook. Tear out the yellow “copy” page and turn this in to your instructor.

1. Watch the video and review proper procedures for using a laboratory balance. Procedures are located in the appendix of this lab manual.
2. Review proper procedures for performing a gravity filtration. Procedures are located in the appendix of this lab manual. List the materials required to complete a gravity filtration.
3. Using information contained in this lab manual, define the term “filtrate” (*see ‘filtration’ under common lab procedures*).
4. Using your own words, write a draft procedure for part II (moisture content) below. Write this in bullet form directly into a new notebook page. This is what you will follow in lab, but you may need to make adjustments as you proceed.

Lab 2.2 Lab Procedure Report

Prepare a procedure that includes all information from the field trip and this week’s lab work. The report needs to be **typed** in paragraph form and written in third-person passive voice. There should be a *minimum* of five parts to the procedure that detail the process of sampling and acquiring data: the field trip, moisture analysis, pH analysis, ion

concentration, and dissolved solids analysis. A procedure for combustion analysis will be completed in a subsequent draft of the procedure. The procedure needs to be detailed enough to make the experiment repeatable. See the sample procedure on Blackboard as an example.