Developing a Monitoring Framework for Detecting Wetland Response to Climate Change in the Adirondack Park

Citizen Scientist Handbook

March 2014 Edition

Prepared by:

New York State Adirondack Park Agency

State University of New York College of Environmental Science and Forestry

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New York State Adirondack Park Agency
SUNY College of Environmental Science and Forestry
New York Natural Heritage Program
SUNY-ESF Northern Forest Institute
Paul Smith's College Center for Adirondack Biodiversity

Coordinated by:

New York State Adirondack Park Agency
P. O. Box 99
1133 NYS Route 86
Ray Brook, NY 12977
Tel: (518) 891-4050
Fax: (518) 891-3938
www.apa.ny.gov

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Cover Photo: An inland poor fen at Paul Smith's College Visitor Interpretive Center, Franklin County, NY (Photo Credit: Samouel Beguin)

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Introduction

Project Overview & Goals:

In 2011, the New York State Adirondack Park Agency (APA) formed a partnership with the SUNY College of Environmental Science and Forestry (ESF), the New York Natural Heritage Program (NYNHP), and the Center for Adirondack Biodiversity (CAB) at Paul Smith's College. APA received a grant from the United States Environmental Protection Agency (EPA) to develop a monitoring program to detect responses of wetlands to climate change in the Adirondack Park utilizing citizen scientists.

For the first phase of the program, project partners prioritized certain types of Adirondack wetlands for monitoring, identified important monitoring criteria, and developed a citizen science training program. This training program was designed to teach Adirondack community members how to collect scientific data on the plants and animals living in wetlands. As the project moves into its second phase, citizen science volunteer teams will receive training and begin collecting data from target Adirondack wetlands.

The primary aim of this handbook is to provide citizen scientists with the information and tools needed to become effective participants in a new wetland monitoring program. This program is designed to help citizen scientists gain new knowledge, forge deeper connections with the natural world, and share in a movement to protect some of the most critical **ecosystems** in the Adirondack Park.

The broader goal of the project is to implement a citizen science monitoring program to facilitate collection of baseline biological data for focal wetlands in the Adirondack Park. This baseline information will allow for analysis of changes over time in the future. Through remote sensing and automated data collection tools, project partners have already gathered data on the physical and geochemical characteristics of target wetlands in the Adirondacks. However, citizen scientist teams are needed for the

phenological field assessment part of project where biological data will be collected on the plants and animals living in wetlands. Combined with existing data, the phenology data collected by citizen scientists will allow us to determine how wetlands are changing over time and how climate change is influencing wetland species and processes. Managers in the Adirondack Park can then use this information to more effectively prioritize wetlands for conservation.

Monitoring & Climate Change:

Climate change is a global phenomenon resulting from an increase in the concentration of carbon dioxide and other **greenhouse gases** in the atmosphere as a result of human activities. We know now that the world is becoming warmer and that the Earth's climate is changing rapidly, but how will this affect us regionally or locally? The effects of climate change are multifaceted, but some examples may include warmer summers and winters, more intense droughts and flooding, and less snow in the winter. Climate change may also lead to more severe, frequent, and unpredictable weather events including storms, wild fires, and floods (Overpeck et al. 1990). In the Adirondacks, we may experience warmer winters, more frequent freeze-thaw events, and more precipitation as rain rather than snow.

As one of the principle threats to **biodiversity**, climate change has the potential to bring about a new wave of species extinctions or local extirpations. Species and ecosystems have responded to climate change by shifting their ranges and distributions to compensate for changing climatic conditions, to which they are not well adapted. For example, some coniferous tree species live mainly at high elevations where temperatures are colder. With climate change, the temperatures at these high elevations will likely increase, and the trees will only be able to survive at higher, cooler elevations. Eventually, the ranges of these species may be reduced so much that they are no longer able to survive where they have been living for thousands of years. These species may face extinction if suitable habitats do not exist elsewhere in their new ranges. In the Adirondacks, climate sensitivity is thought to be high because of the temperate-boreal

ecotone that marks the transition from biological communities that require warmer conditions and those that require colder conditions (Beier et al. 2012).

Freshwater ecosystems are some of the most vulnerable to climate change (Woodward et al. 2010). Freshwater wetlands in particular are thought be particularly at risk. Many of the plants and animals that depend on wetlands for their habitats could be left with nowhere to live as a result of climate change and other **stressors** like pollution and urban development. High elevation wetlands like those found in the Adirondacks are likely to be particularly vulnerable given their cold, **boreal** character. In order to help protect wetlands in the Adirondack Park, we will build a monitoring network that will allow us to identify changes in wetlands as a result of climate change. Over time, data on the plants and animals living in wetlands will allow us to respond to those changes through management strategies and conservation programs. In this way, we can prioritize which wetlands need to be conserved and then more effectively protect these essential ecosystems.

Citizen Science:

Citizen science is a rapidly expanding field where community volunteers join in the process of collecting biological or environmental data. Citizen science can be particularly useful for long-term monitoring programs that cover a broad geographical range. Existing citizen science programs have targeted water quality, breeding birds, frogs, dragonflies, mammals, and many other ecological subjects. Such programs allow for rich dialogues and transfer of information between professional scientists and community volunteers that bring about more effective and informed strategies to preserve and protect the natural resources and ecosystems that we all rely on and cherish.

Citizen scientist teams are able to collect large amounts of data from a large area -- something that professional scientists could not accomplish alone. The digital age makes this easier than ever before thanks to the power of Internet communication, data sharing, and smartphone applications that permit observations to be recorded in the field. Best of all, citizen scientists

serve as environmentally literate members of society who understand the true value of life on Earth and the water, land, and air that sustain it.

As a citizen scientist, you will contribute directly to ecological research that will specifically help with preserving Adirondack wetlands. Participation in this project will allow you to access a number of natural areas not typically open to the general public, gain skills identifying and observing Adirondack flora and fauna, and join a community of people committed to exploring and conserving these diverse habitats. As a member of a community of highly skilled volunteers, you will be able to work with professional scientists and other experts to educate the broader general public about the importance of wetlands and our efforts to conserve them for future generations.

Wetland Ecology:

Wetlands come in many forms with many different names. For example, you may have heard of marshes, swamps, bogs, or fens. While these terms can be confusing, they are used to classify wetlands that have different sources of water, different plant and animal communities, and different geological stories. Regardless of the names used to describe them, all of these wetlands provide important **ecosystem functions** and **ecosystem services**. For example, wetlands store water during times of drought, absorb water to reduce flooding, purify water that ends up in the groundwater that many of us rely on for drinking water, and provide habitats to a host of plants, animals, and other living things (Mitsch and Gosselink 2007). Wetlands are also valuable to humans in more direct ways for research, education, outdoor recreation, hunting, and wildlife viewing.

Wetland ecology refers to the study of the interactions among wetland organisms and their environments. These interactions may involve the smallest organisms (bacteria, mosses) or much larger organisms like spruce trees or moose. Wetland ecologists are often interested in how the essential components of life like carbon, nitrogen, and water are processed, absorbed, or released by wetland habitats. Other scientists may study the **succession** or distribution different plant communities that live in wetlands.

Additional wetland research could focus on the breeding behavior or distribution of birds or amphibians, the ways that wetland "food chains" (**trophic interactions**) function, or the competition among different plant or animal species. These topics represent only a small fraction of the directions of study in these complex and fascinating ecosystems. For more detailed information on the ecology of wetlands, please check out the books and other resources listed in the "References" section on page 45.

NOTES:

Chapter 1: Peatlands

What are peatlands?

Of all the types of wetlands in the Adirondack Park, we decided to begin this monitoring project with **peatlands** because they are thought to be especially vulnerable to climate change (Jenkins 2010). In the Adirondacks, peatlands contain species that are at the southern extremes of their ranges, are strongly influenced by changes in hydrology, and have a broad geographic extent. After starting the program with peatlands, we will then be able to move on to marshes, swamps, floodplain forests, and other types of wetlands.

A peatland is a type of wetland where wet and cold conditions allow plants to grow and die, but not to decompose. Instead, these dead plants accumulate as peat soil, often for millennia. Over time, an enormous amount of carbon is stored in peatlands. Globally, nearly one-third of all the carbon bound up in terrestrial plants and animals is stored in peatlands (Gorham 1991). The most definitive characteristic of a peatland is the presence of water-saturated peat soil, which is primarily composed of living or dead **Sphagnum moss**.

In the Adirondacks, peatlands include both bogs and fens. These two types of peatlands systems have very different chemistry and thus, different plant community composition. **Bogs** are defined by their high acidity and low nutrient availability, a result of their **hydrology**, position in the landscape, and the plants that have dominated.

A large, open peatland in the Adirondack Park.

Because bogs often occur at the highest parts of a watershed and have no streams running in or out of them, they receive most of their water from precipitation. This means that geology, soils, and other vegetation do not buffer the chemistry of these systems. Sphagnum moss is well adapted to grow in the cool, acidic conditions of bogs. Sphagnum mosses are able to capture nutrients, which creates even more acidic conditions. This means that only a few other plants with high tolerances to acidity are able to grow in bogs. The **pH** of bogs can be as low as 3.2, like vinegar. Besides Sphagnum, other plants that are well adapted to harsh bog conditions include **sedges**, dwarf-shrubs, and trees such as Black spruce (*Picea mariana*).

Fens are similar to bogs in that they also have peat soils, but since they receive some water from streams or groundwater, the chemistry of fens is less acidic. Fens have greater **species richness** than bogs and support taller shrubs and trees like Northern white cedar and a variety of very rare plant species. For example, over 500 species of rare plants have been documented at a fen in western New York! Fens are relatively rare in the Adirondacks because the bedrock in the region contributes to very low amounts of base cations to the water.

Peatlands provide habitats for many living things. In addition to Sphagnum mosses, peatlands also contain a variety of other mosses and lichens, which often cover the bark and branch surfaces of trees. Peatlands have many types of herbaceous plants and shrubs, and most have several different species of trees. Some common peatland plant species include Bog rosemary, Few-seeded sedge, Leatherleaf, Sheep-laurel, Tamarack (Larch), Black spruce, Small cranberry, and the Pitcher-plant. Other plant groups include orchids, aquatic plants, and sundews, which are capable of capturing and digesting insects.

Dragonflies, ants, crickets, and many tree-feeding insect species can be also found in peatlands. Ants and crickets can be observed on the peat moss surface, while dragonflies usually hunt for prey just above the peat layer. Amphibians and reptiles can also be found in or near the edges of peatlands. Amphibians may include Northern leopard frogs, spring

peepers, chorus frogs, and green frogs, all of which can found in areas of peatlands where sedge mats develop. Some turtle and snake species may be seen near peatlands, though usually these reptiles are seen in other types of wetlands like marshes where there is more open water.

Other animals associated with peatlands include birds and mammals. Many bird species associate with peatlands, with some building nests on sphagnum mats and others hunting for insects on peatland plants. Some bird species may spend more time along the borders of the peatlands. Bird groups found in or near peatlands include flycatchers, jays, sparrows, warblers, waterfowl, woodpeckers, and wrens. Several mammal species rely on peatland trees and shrubs as food sources. Some of these peatland visitors include red squirrels, snowshoe hares, white-tailed deer, and moose. Smaller peatland mammals can include water shrews, star-nosed moles, and meadow voles.

Within the peatlands selected for this project, we would like to monitor both the **abiotic** and **biotic** conditions at each site. Abiotic conditions may include **hydrology**, nutrient levels, or temperature. We will also consider biotic information on the organisms that live in peatlands. We have chosen to focus on three taxonomic groups that serve as **ecological indicators** of the effects of climate change on peatland ecosystems as a whole as well as the effects on plants, amphibians, and birds that live in peatlands. We will then examine how the distribution, abundance, and **phenology** of these organisms change over time. This will help use understand how climate change is affecting the wetlands.

Phenology:

Phenology is the study of the timing of biological events. We are interested in how the starting and ending dates of these events may be affected by climate change. Essentially, we want to know when wetland plants are flowering and growing, when different amphibian species beginning their evening choruses, and when different bird species begin attracting mates and breeding. By recording the dates of each of these events (**phenophases**), we can determine how warmer temperatures or

other climate change factors may be influencing the interactions between these organisms and their environment. Thanks to past information on the timing of biological events, we can also compare the data that we collect to historical records to see how the regional climate and ecosystems have changed. Changes in phenology can affect ecosystem structure and function in a variety of ways. For example, if plants emerge, grow, and mature faster than usual in the spring and summer, animals like insects or birds may have trouble finding plant-based food resources that were predictably available in the past. We can think of this concept as "phenological decoupling."

Chapter 2: Plant Monitoring

What is a vegetation survey?

A vegetation survey is a way to find out which plants live at a specific location and how these plants are growing, interacting with other organisms, or responding to environmental changes. A reference condition survey of each study site will be conducted by professional staff so that change in the structure and distribution of the vegetation can be detected over time. Since this project is also focused on plant phenology, citizen scientists will visit survey sites and record information on **phenophases** of common plants. For these monitoring surveys we will be recording information such as leaf emergence and senescence, and flowering and fruiting times of individually marked plants along 'phenology trails' at the study sites.

Peatland Plant Species:

We have developed a list of 12 common peatland plants including trees, shrubs, and herbaceous plants. These plants are readily identified with practice.

1. Balsam fir (*Abies balsamea*)
2. Black spruce (*Picea mariana*)
3. Bog laurel (*Kalmia polifolia*)
4. Bog rosemary (*Andromeda polifolia*)
5. Few-seeded sedge (*Carex oligosperma*)
6. Labrador tea (*Rhododendron groelandicum*)
7. Leatherleaf (*Chamaedaphne calyculata*)
8. Pitcher-plant (*Sarracenia purpurea*)
9. Rose pogonia (*Pogonia ophioglossoides*)
10. Sheep-laurel (*Kalmia angustifolia*)
11. Small cranberry (*Vaccinium oxycoccos*)
12. Tamarack/Larch (*Larix laricina*)

Pitcher-plant

In addition to these 12 species, each peatland site may have two or three other "site-specific" species that you will be taught to identify and observe in the field. Using these plant surveys, we will be able to look at how different groups of plants are responding to climate variables like temperature.

Plant Monitoring Protocol:

The initial reference condition survey of the study sites will be conducted by professional staff. If possible, volunteers will be invited to assist in this process providing an opportunity to:

1. Learn about assessment protocols and get exposed to plant identification,
2. Help establish the phenology trail (see below)
3. Become familiarized with the site.

Our plant phenology surveys will be conducted along pre-established paths at wetland sites. Because peatlands vegetation is sensitive to trampling we must take care to establish trails in such a way that minimizes these impacts and maximize our ability to observe the plants Citizen Scientists will visit their study sites daily and record vegetative, reproductive and fruit/seed phenophases of each of the marked plants. These observations are slightly different depending on the type of plant but include the following:

- Vegetative Phenophase
    - Initial growth
    - Leaf bud break
    - Leaf maturity
    - Leaf color
    - Leaf fall
- Reproductive Phenophase
    - Flower buds
    - Flowering
    - Pollen release/receptence

- Fruit/Seed Phenophase
    - Fruiting
    - Ripe fruit/seeds
    - Fruit/seed drop .

Please see Chapter 5 for the plant phenology data sheet and an *example* of a completed data sheet.

Step-by-step Protocol:

- Based on the monitoring schedule and details provided at training sessions, determine the dates and sites to which you have been assigned
- On each of your monitoring dates, determine if weather conditions are safe and adequate for field surveys
- If conditions are good, **notify a friend or family member as to where and when you will be out** and travel to your peatland site access point during the day
- Navigate to the start of your sites phenology trail using the GPS, compass, and map
- Make sure the location of the trail is marked and clearly visible to you
- Fill out the top portion of a plant phenology data sheet (p. 23)
- Record target species characteristics
- Take digital photos liberally with a GPS enabled camera, or make note of photo locations
- Make additional observations and notes in your field journal
- Return to the site access point and return home
- Contact your friend or family to tell them that you have returned.

Equipment List:

NOTE: We will explain how to use these items during training sessions

Clipboard – writing surface and storage container for data sheets
Compass – helps you locate the permanent plots
Copy of protocol – helps remind you of the monitoring methods
Data sheets – used to record data on plant species and their phenophases
GPS – helps you locate the permanent plots
GPS camera – used to photograph the target plant species and the plots
Hands lens – used to observe plant parts with greater detail
Identification guides – provide help for field identification of plants
Meter stick – used to measure the height and length of plants or plant parts
Pack – used to store gear and transport equipment to and from the site
Pencils – for writing down data and other observations
Plant cover diagrams – help you estimate the percent cover for each species (**NOTE**: this step may not be required)
Site map – helps you locate the peatland and the permanent plots
Tape measure – used to measure distances
Waders/hip boots – for staying dry and protecting feet and legs

In addition to these things, you must bring the items listed in the "Field Safety" section of Chapter 5 (see p. 21).

Chapter 3: Amphibian Monitoring

What is a nocturnal call survey?

A nocturnal **call survey** is a means of recording the species of **anurans** (frogs and toads) that are singing after sunset. These surveys will be conducted from specific **call survey points** within or on the edge of each peatland site. Call survey methods were developed by the United States Geological Survey (USGS) and will allow us to detect changes in the timing of breeding of frogs and toads, as well as whether or not certain species are present at wetlands. By conducting repeated surveys, we can also figure out how likely we are to hear a frog species calling if it is indeed present at a wetland site (**detection probability**). This is important, as it helps us determine how likely it is that the absence of a frog species calling during our surveys represents the true absence of a species from that wetland, or whether it was there but simply not heard calling.

Peatland Anuran Species:

Below is a list of the most common frog and toad species found in the Adirondack Park. While all of these species can be heard calling, certain species begin singing earlier in the spring than others. In addition, some species have longer calling periods than others and may continue to sing through the month of July.

1. American Bullfrog (*Lithobates catesbeianus*)
2. American Toad (*Anaxyrus americanus*)
3. Green Frog (*Lithobates clamitans*)
4. Gray Tree Frog (*Hyla versicolor*)
5. Mink Frog (*Lithobates septentrionalis*)
6. Northern Leopard Frog (*Lithobates pipiens*)
7. Pickerel Frog (*Lithobates palustris*)
8. Spring Peeper (*Pseudacris crucifer*)
9. Western Chorus Frog (*Pseudacris triseriata*)
10. Wood Frog (*Lithobates sylvaticus*)

American Toad

Step-by-step Protocol:

- Based on the monitoring schedule and details provided at training sessions, determine the dates and sites to which you have been assigned
- On each of your monitoring dates, determine if weather conditions are safe and adequate for field surveys (Winds >12 mph and/or heavy rain is NOT suitable)
- If conditions are good, **notify the project coordinator where and when you will be out** and travel to your peatland site access point a little before sunset
- Navigate to the first call survey point using the GPS, compass, and map
- Measure and record the water temperature of the peat surface (stick thermometer into the peat mat)
- While the temperature is being read, start filling out the top portion of the data sheet
- Ideally, begin listening at least 30 minutes after the sun has set
- Stay quiet for at least 3 minutes before starting the first listening period
- Prepare to listen for the first listening period
- Turn the audio recorder on (details will be discussed during training sessions)
- Start the 5-minute timer
- Close your eyes, cup your hands around your ears, and listen for frogs and toads for the full time period
- Record species heard during the listening period and the call index (1 = individuals distinguishable / 2 = individuals, but with overlapping calls / 3 = full chorus (completely overlapping calls))
- Conduct two more listening periods following the same steps
- Make sure to retrieve the water thermometer and record the water temperature
- Navigate to the next call survey point and repeat the process (NOTE: you may only have one survey point at your site)
- When finished with all call survey points, make sure you have all of your equipment and return to the site access point. Safe travels back home!

Equipment List:

NOTE: We will explain how to use these items during training sessions

Audio recorder – used to record the amphibians heard (you may be able to use a smartphone)
Clipboard – writing surface and storage container for data sheets
Compass – helps you locate the call survey points
Copy of protocol – helps remind you of the monitoring methods
Data sheets – used to record data on amphibians heard
Flashlight/Headlamp and extra batteries – **ESSENTIAL!** Helps you find your way to and from the survey points
GPS – helps you locate the call survey points
Pack – used to store gear and transport equipment to and from the site
Pencils – for writing down data and other observations
Site map – helps you locate the peatland and the survey points
Thermometer – used to measure the water temperature near the survey point
Waders/hip boots – for staying dry and protecting feet and legs
Watch with timer – used to measure the duration of the listening periods

In addition to these things, you must bring the items listed in the "Field Safety" section of Chapter 5 (see p. 21).

Chapter 4: Bird Monitoring

What is a point count?

A point count is essentially a survey used to identify birds by sight and sound. These surveys will involve identifying the number of species and counting the number of individuals seen or heard from a discrete survey point over a short period of time (10 minutes). Because we are interested in the timing of breeding and bird species arrivals, we will be starting these surveys in May.

Peatland Bird Species:

We have developed lists of Adirondack birds that are commonly associated with these kinds of wetlands. The first list includes 12 target species that all citizen scientists will learn to identify. Another list includes 20 additional species that some citizen scientists may wish to learn to identify. This second list is also appropriate for citizen scientists who already have bird watching experience (see "Appendices" p. 42-44).

1. Black-capped Chickadee (BCCH)
2. Blue Jay (BLJA)
3. Common Yellowthroat (COYE)
4. Hermit Thrush (HETH)
5. Least Flycatcher (LEFL)
6. Lincoln's Sparrow (LISP)
7. Nashville Warbler (NAWA)
8. Olive-sided Flycatcher (OSFL)
9. Purple Finch (PUFI)
10. Swamp Sparrow (SWSP)
11. White-throated Sparrow (WTSP)
12. Winter Wren (WIWR)

White-throated Sparrow

Step-by-step Protocol:

- Based on the monitoring schedule and details provided at training sessions, determine the dates and sites to which you have been assigned
- On each of your monitoring dates, determine if weather conditions are safe and adequate for field surveys (Wind >12 mph and/or heavy rain are not suitable)
- If conditions are good, **notify the project coordinator where and when you will be out** and travel to your peatland site access point a little before sunrise
- Navigate to the first call survey point using the GPS, compass, and map
- Record the time of sunrise and fill out the top portion of the data sheet
- Remain quiet for at least 3 minutes before starting the first survey period
- Turn the audio recorder on (details will be discussed during training sessions)
- Start the 10-minute timer
- Watch and listen for birds for the 10-minute survey period
- You may look at birds with binoculars or a scope during the observation period, but make sure another person is scanning for other moving birds as you do (one member of your party should always have an "eye on the sky")
- Record species heard and seen during the survey period, the number of each seen species, the estimated distance between you and the birds, and any comments or notes
- Make sure to record birds in proper time section of the data sheet depending on when you saw or heard them during the survey period
- Conduct two more listening periods following the same steps
- Navigate to the next survey point and repeat the process (NOTE: you may only have one survey point at your site)
- When finished with all call survey points, make sure you have all of your equipment and return to the site access point
- Safe travels back home!

Equipment List:

NOTE: We will explain how to use these items during training sessions

Audio recorder – used to record the birds heard (you may be able to use a smartphone)
Binoculars – used to observe and identify distant birds
Clipboard – writing surface and storage container for data sheets
Compass – helps you locate the survey points
Copy of protocol – helps remind you of the monitoring methods
Data sheets – used to record data on birds seen and heard
Field guides – used to help identify unknown birds in the field
Flashlight/Headlamp with spare batteries – makes working in the dark safer and easier
GPS – helps you locate the call survey points
Pack – used to store gear and transport equipment to and from the site
Pencils – for writing down data and other observations
Site map – helps you locate the peatland and the survey points
Spotting scope – optional; may be helpful for long range identification
Waders/hip boots – for staying dry and protecting feet and legs
Watch with timer – used to measure the duration of the survey periods

In addition to these things, you must bring the items listed in the "Field Safety" section of Chapter 5 (see p. 21).

Chapter 5: Monitoring Logistics

Field Safety:

When involved with a field research project of any kind, it is essential that you consider safety first. First, you need to determine if the conditions will be appropriate for time spent outside in remote locations. In other words, if the weather is bad or the forecast predicts bad weather when you will be in the field, you SHOULD NOT go. Bad weather includes high winds, risk of thunderstorms, storm warnings or watches, and heavy rain. If you are unsure if conditions will be safe for your planned monitoring trip, contact the project coordinator. Assuming conditions are suitable for fieldwork, you MUST inform the project coordinator via phone or email where you will be going, when you will be leaving and returning, and the names and number of people in your group. NEVER GO INTO THE FIELD ALONE! To ensure safe operations in the field, you must make sure that you bring the equipment listed below. We will discuss the use of these items during training sessions. Being prepared is essential, particularly in the Adirondacks!

Essential Gear List:

- Map, Compass, GPS, Cellphone
- Sunglasses, hat, sunscreen
- Warm clothing, raincoat, rain pants, warm hat and gloves
- Sturdy footwear/waders/hip boots
- Headlamp/Flashlight (headlamp preferred), extra batteries
- First-aid Kit, any essential medications, EpiPen if needed
- Weatherproof matches/lighter/candle, kindling/firestarter
- Repair kit/tools, pocket knife
- Watch
- Snacks, enough food for at least one good meal
- Water
- Tarp/trash bags to stay dry in the event of severe weather

Emergencies:

As part of training sessions, we will discuss strategies for dealing with emergency situations in the field. Above all, make sure that you go into the field only when the conditions are good, only when you have notified the project coordinator where and when you will be out, only when you have others to go with you, and only when you have all essential equipment.

Effective Data Collection:

To be effective citizen scientists, you will need to practice collecting data and learn to replicate the same methods over and over again. Monitoring work is sort of like a favorite food recipe: in order to cook a tasty dish, you need to add the correct amounts of the different ingredients every time you're making it. We will be able to help you practice to make sure you feel comfortable replicating methods. Also, many resources will be available to answer your questions and concerns as you start to collect data at peatland sites.

Field Data Sheets:

During training sessions, you will learn how to fill out data sheets and conduct the monitoring protocols found in Chapters 2, 3, and 4. We will also discuss where to obtain additional data sheets and how completed data sheets should be submitted. The following pages contain blank draft versions of the data sheets (which can be photocopied if needed) and example versions of the data sheets.

NOTE: Updated data sheets will be provided if changes in protocol occur. The actual data sheets used for monitoring may differ from those presented here.

DRAFT PLANT MONITORING DATA SHEET

Researchers	
Phone # & email	
Date	
Start time	
End time	

Site Name:		
Site Code:		
Site Coordinates:		
Elevation:		
Site Type:		
Nearest Road:		
Town:		

Temperature:	
Wind:	
Cloud Cover:	
Precipitation:	

Permanent Plot # ____		**Code:**										
Seen?	**Target Species**	**Vegetative Phenophase**					**Reproductive Phenophase**			**Fruit/Seed Phenophase**		
	Balsam fir											
	Black spruce											
	Bog laurel											
	Bog rosemary											
	Few-seeded sedge											
	Labrador tea											
	Leatherleaf											
	Pitcher-plant											
	Rose pogonia											
	Sheep-laurel											
	Small cranberry											
	Tamarack/Larch											
	Site-specific 1:											
	Site-specific 2:											
	Site-specific 3:											

DRAFT PLANT MONITORING DATA SHEET
(EXAMPLE ONLY – NOT REAL DATA)

Researchers:	John Bogworth, Liza Bogworth, Randall Peatman
Phone # & email:	(555) 871-0133 jbogworth@mail.net
Date:	Wednesday, 20 June 2014
Start time:	10:00 AM
End time:	12:00 PM

Site Name:	Good Hollow Bog	
Site Code:	GH/B 1A	
Site Coordinates:	44.56988 N	- 73.22299 W
Elevation:	444 m	
Site Type:	Sphagnum bog	
Nearest Road:	NYS Route 334 / Good Hollow Road	
Town:	Pine Lake	

Temperature:	20°C (68°F)
Wind:	Light breeze from southeast
Cloud Cover:	Mostly sunny, only about 10-15%
Precipitation:	None

Permanent Plot # 1		**Code:** FH/B 1A-PP1										
Seen?	**Target Species**	**Vegetative Phase**					**Reproductive Phase**			**Fruit/seed Phase**		
	Balsam fir	0										
Yes	Black spruce	3	13	16	10			140	110	76		
Yes	Bog laurel	10	0	2	0	3	2	30	25	31	20	31
Yes	Bog rosemary	8	4	6	2	4	6	10	14	11	13	12
	Few-seeded sedge	0										
	Labrador tea	0										
Yes	Leatherleaf	18	6	8	8	4	10	22	35	38	32	36
Yes	Pitcher-plant	2	1	1	0	1		21	15	10	16	

	Rose pogonia	0										
	Sheep-laurel	0										
Yes	Small cranberry	1	0	0	0	2	0	2	4	5	3	4
Yes	Tamarack/Larch	2	18	14	0			230	180	86		
Yes	SS1: *Rhynchospora alba*	5	0	1	1	1		32	28	24	26	
Yes	SS2: *Eriophorum virginicum*	3	0	1	0	0	0	21	22	30	16	24

DRAFT AMPHIBIAN MONITORING DATA SHEET

Researchers	
Phone # & email	
Date	
Start time	
End time	

Site Name:		
Site Code:		
Site Coordinates:		
Elevation:		
Site Type:		
Nearest Road:		
Town:		

Temperature:	
Wind:	
Cloud Cover:	
Precipitation:	

Call Survey Point # ____		**Code:**	**Start:**
Water Temperature:		**Listening Period:** min.	**End:**
Heard?	**Target Species**	**Call Index**	**Notes**
	Spring Peeper		
	Western Chorus Frog		
	Wood Frog		
	Pickerel Frog		
	Northern Leopard Frog		
	American Toad		
	Gray Tree Frog		
	Green Frog		
	American Bullfrog		
	Mink Frog		

DRAFT AMPHIBIAN MONITORING DATA SHEET
(EXAMPLE ONLY – NOT REAL DATA)

Researchers	Susan Frogworth, Jenny McToad
Phone # & email	(555) 841-0222 sfrogworth@mail.net
Date	Friday, 6 June 2014
Start time	8:30 PM
End time	9:00 PM

Site Name:	Good Hollow Bog	
Site Code:	GH/B 1A	
Site Coordinates:	44.56988 N	- 73.22299 W
Elevation:	444 m	
Site Type:	Sphagnum bog	
Nearest Road:	NYS Route 334 / Good Hollow Road	
Town:	Pine Lake	

Temperature:	25°C (68°F)
Wind:	Calm, almost no wind at all
Cloud Cover:	Clear, stars becoming visible after sunset
Precipitation:	None, though thunderstorms in past 24-48 hours

Call Survey Point # 4		**Code:** GH/B 1A-CSP4	**Start:** 8:45
Water Temperature: 22°C		**Listening Period:** 5 min.	**End:** 8:50
Heard?	**Target Species**	**Call Index**	**Notes**
	Spring Peeper		
	Western Chorus Frog		
	Wood Frog		
	Pickerel Frog		
	Northern Leopard Frog		
Yes	American Toad	1 - could count individuals	Only heard one time
Yes	Gray Tree Frog	3 - full chorus	
	Green Frog		
Yes	American Bullfrog	2 - individuals, overlapping	At least 2 individuals
Yes	Mink Frog	1 - could count individuals	Only 1 or 2 individuals

DRAFT BIRD SURVEY MONITORING SHEET

Researchers	
Phone # & email	
Date	
Start time	
End time	

Site Name:		
Site Code:		
Site Coordinates:		
Elevation:		
Site Type:		
Nearest Road:		
Town:		

Temperature:	
Wind:	
Cloud Cover:	
Precipitation:	

Call Survey Point #:	**Call Survey Point Code:**				**Start Time:**		**End Time:**		**Sunrise:**
Species Code	**1-3 min.**		**4-6 min.**		**7-10 min.**		**Fly-overs**	**TOTAL**	**Notes**
	<50 m	**>50 m**	**<50 m**	**>50 m**	**<50 m**	**>50 m**			
BCCH									
BLJA									
COYE									
HETH									
LEFL									
LISP									
NAWA									
OSFL									
PUFI									
SWSP									
WIWR									
WTSP									

Species Code	1-3 min.		4-6 min.		7-10 min.		Fly-overs	TOTAL	Notes
	<50 m	>50 m	<50 m	>50 m	<50 m	>50 m			
ALFL									
BBWA									
BBWO									
BLPW									
BRCR									
CAWA									
CAWR									
CMWA									
CSWA									
GRAJ									
MAWA									
PAWA									
PISI									
RUBL									
SPGR									
TEWA									
TTWO									
WWCR									
YBFL									
YRWA									
					Total # of individuals				
					Total # of species				

DRAFT BIRD MONITORING DATA SHEET
(EXAMPLE ONLY – NOT REAL DATA)

Researchers	Bob Birdee, Kelly Birdee, Ralph Falcondon
Phone # & email	(555) 751-0312 bobbirdlover@mail.net
Date	Sunday, 30 May 2014
Start time	5:30 AM
End time	7:00 AM

Site Name:	Good Hollow Bog	
Site Code:	GH/B 1A	
Site Coordinates:	44.56988 N	- 73.22299 W
Elevation:	444 m	
Site Type:	Sphagnum bog	
Nearest Road:	NYS Route 334 / Good Hollow Road	
Town:	Goodville	

Temperature:	13°C (56°F)
Wind:	Wind from northwest
Cloud Cover:	Overcast becoming 80% cloudy (some sun around 6:45)
Precipitation:	Drizzle at 5:00 near Saranac Lake, but none at site

Call Survey Point #:	**Call Survey Point Code:**				**Start Time:**		**End Time:**		**Sunrise:**
Species Code	**1-3 min.**		**4-6 min.**		**7-10 min.**		**Fly-overs**	**TOTAL**	**Notes**
	<50 m	**>50 m**	**<50 m**	**>50 m**	**<50 m**	**>50 m**			
BCCH		2		3				5	
BLJA							1	1	Flew from forest across wetland
COYE					2			2	
HETH				1				1	
LEFL									
LISP					1			1	
NAWA									
OSFL									

PUFI									
SWSP	1		1		1			2	
WIWR									
WTSP			2					2	Very close

Species Code	1-3 min.		4-6 min.		7-10 min.		Fly-overs	TOTAL	Notes
	<50 m	>50 m	<50 m	>50 m	<50 m	>50 m			
ALFL									
BBWA									
BBWO									
BLPW									
BRCR									
CAWA									
CAWR									
CMWA									
CSWA									
GRAJ									
MAWA					1			1	Bog edge
PAWA									
PISI									
RUBL									
SPGR									
TEWA									
TTWO									
WWCR									
YBFL									
YRWA									
CEDW					3			3	
RTHA							1	1	High above north edge of bog

Total # of individuals	19
Total # of species	10

NOTES:

Chapter 6: Data & Resources

Data Management:

After filling out plant, amphibian, and bird data sheets in the field, citizen scientists must submit this information to the project coordinator and the project database. All of the date will be compiled by the NYNHP into a database housed at the APA. As more and more data are added to the system, researchers will be able to study changes at the target wetlands over space and time. Data sheets, photographs, and audio recordings will all be important components of the wetland monitoring framework. As citizen scientists, you will have the opportunity to see results, photos, and progress of other citizen scientists through the website and social media pages.

Other Field Observations:

In addition to the official data sheets, we encourage citizen scientists to record other observations and notes in a field notebook. We will discuss the basics of keeping a field notebook during the training modules. We also encourage participants to take photos, record short videos of field teams in action, and make audio recordings of interesting sounds. Unless a project staff member or a professional scientist is present and authorizes it, please DO NOT collect any plants or other materials at peatland sites. More than most people, you know how fragile and special these wetlands are – please maintain a conservation ethic and "leave no trace"!

Smartphone Applications:

Citizen scientists are encouraged to take advantage of the innumerable smartphone applications available that may of use in the field. Audio recording apps, digital fields guides, tools designed specifically for citizen scientists (iNaturalist, eBird), flashlight apps, and compass apps may all have a place in this project. As this project continues to grow and evolve, we may decide to implement a new application specifically designed for

Adirondack wetland monitoring. We will be sure to let you know if this happens!

Online Resources:

NOTE: Online resources will be introduced to citizen scientists as they appear and during training sessions. Please stay tuned!

Frequently Asked Questions & Support:

NOTE: This section will be completed in a future version of the handbook. Please contact the following program leaders with questions:

David Patrick
Center for Adirondack Biodiversity
Paul Smith's College
Routes 86 and 30, Paul Smiths, New York 12970
Phone: 518-327-6174 Email: dpatrick@paulsmiths.edu

Paul B. Hai
Adirondack Ecological Center of SUNY College of Environmental Science and Forestry
6312 Route 28N, Newcomb, NY 12852
Phone: 518-582-4551 x104 Email: pbhai@esf.edu

Appendices

Glossary of Terms:

Sources: New Oxford American Dictionary, NYSERDA (2011) ClimAid Report 11-18, Ch. 6 (Ecosystems)

Abiotic – adjective describing the non-living parts of an ecosystem (e.g. bedrock, sunlight, temperature, water, wind).

Anuran – refers to the taxonomic order Anura that includes frogs and toads.

Biodiversity – the variety of life on Earth at all its levels including genetic material, unicellular microbes, plants, animals, community types, ecosystems, and biomes.

Biotic – adjective describing the living parts of a system (e.g. algae, animals, bacteria, fungi, insects, plants, soils).

Bog – a type of wetland; a type of acidic peatland that usually forms in a glacial lake depression and is dominated by Sphagnum mosses and shrubs. Water and nutrients come from precipitation rather than groundwater or streams.

Boreal – adjective referring to the cold, Northern climatic zone south of the Arctic.

Call survey – a scientific field method used to identify animals present at a specific location based on their songs or other vocalizations.

Call survey point – a discrete location from which to conduct a call survey.

Citizen science – a fairly new discipline that relies on trained non-experts to collect scientific data on certain species or ecosystems and submit this information to large databases used by research organizations to better understand environmental problems or systems.

Climate change – a current global phenomenon resulting from the increase in carbon dioxide and other greenhouse gases in the atmosphere. Rising global temperatures, changing precipitation patterns, and melting ice will bring about unprecedented changes on Earth.

Detection probability – the likelihood of hearing a species of amphibian or other animal known to live at a particular site.

Ecological indicators – species, events, or other variables that help us understand how the impacts on ecosystems.

Ecosystem – the collection of biological organisms and their physical environment and the interactions among living and nonliving things. Includes individuals, species, populations, communities, and abiotic factors like air, nutrients, sunlight, and water.

Ecosystem functions – indirect benefits that ecosystems provide to humans and other living things (e.g. nutrient cycling, primary production, groundwater recharge).

Ecosystem services – direct benefits that ecosystems provide to humans and other living things including harvested resources like timber or food products, clean water, flood/erosion control, soil conservation, carbon sequestration, and recreational opportunities.

Ecotone – a transition zone between different types of biological communities (e.g. between temperate forest and boreal forest).

Fen – a type of wetland; a less acidic peatland usually dominated by Sphagnum mosses, shrubs, and stunted trees where water and nutrients come from groundwater, precipitation, and sometimes streams.

Greenhouse gases – gases like carbon dioxide, methane, and chlorofluorocarbons that absorb infrared radiation and warm the atmosphere.

Hydrology – the study of the movement, cycling, and exchange of water; often refers to how water moves across a system or an area of land.

Peatlands – types of wetlands that are usually dominated by Sphagnum mosses, shrubs, and small trees. Though saturated with water, peatlands do not have a lot of open water like in a marsh. Peatlands are usually less forested than other wetlands like swamps, though several types of forested peatlands can be found in the Adirondacks.

Percent cover – the amount of space that a particular species or other thing occupies in a known area

Permanent plot – a marked area (often a rectangle or circle) used for long-term scientific research.

Phenology/Phenological – the study of the timing and seasonality of biological events / referring to the timing of biological events.

Phenophase – a biological event that occurs at a specific time of year (e.g. plant bud burst, plant flowering, release of seeds or pollen, migratory bird arrival, frog breeding choruses, date of killing frost).

Point count – a scientific field method used to identify animals present at a specific location based on visual identification (sight).

Site access point – a location where researchers can find a trail or other route that brings them to a specific study site

Sphagnum moss – plants in the genus *Sphagnum*; peat mosses that grow mainly in bogs and fens. These mosses create acidic conditions in wetlands and decompose very slowly. Dried Sphagnum peat moss is a commonly used commercial horticulture product.

Stressor – some environmental factor that puts stress on living organisms that may compromise their ability to survive or reproduce (e.g. climate change, pollution, habitat destruction, invasive species arrival, herbivores, insect pests, fire, drought, flood, storm).

Succession – a process of gradual or sudden transition from one type of plant or animal community to another; often occurs in stages until a stable climax community is attained (though succession can begin again if a disturbance like a fire disrupts the climax community).

Trophic interactions – the feeding relationships among different groups of organisms living in the same ecosystem; commonly referred to as "food chains," these interactions include the consumption of plants by animals, the consumption of prey animals by other predator animals, and the decomposition of dead plants and animals by bacteria and other microorganisms.

Wetlands – habitats or ecosystems where the soil or ground is saturated or flooded with water for at least part of the year; commonly defined by the presence of specific communities of plants growing in the same area. Wetlands are found all over the world and include bogs, fens, marshes, swamps, vernal pools, and coastal/lakeshore meadows.

Species Lists:

Plants

Target Species:

NOTE: Descriptions and photos are shown for two species. The other entries will be completed for a future version of the handbook. You will learn how to identify target species during training sessions.

Balsam fir (*Abies balsamea*)

Black spruce (*Picea mariana*)

Bog laurel (*Kalmia polifolia*)

Bog rosemary (*Andromeda polifolia*)

Few-seeded sedge (*Carex oligosperma*)

Labrador tea (*Rhododendron groelandicum*)

Leatherleaf (*Chamaedaphne calyculata*)

Pitcher-plant (*Sarracenia purpurea*) – an herbaceous plant that grows close to the peat surface. Easily recognized by the green or reddish pitcher-shaped structures that grow in clusters and fill with liquid and attract insect prey. Flower stands up to 1 m high and is dark purple. Pitcher-plants are usually found in more acidic peatlands where fewer nutrients are available to plants.

Rose pogonia (*Pogonia ophioglossoides*)

Sheep-laurel (*Kalmia angustifolia*)

Small cranberry (*Vaccinium oxycoccos*)

Tamarack/Larch (*Larix laricina*) – one of the main peatland tree species. Has light green needles arranged in star-shaped tufts along branches. Needles are deciduous, so they change color and drop off in the fall. Tamaracks growing in peatlands usually range in height from small seedlings <20 cm tall to tall trees >5 m tall.

Additional "Expert" List:

Black chokeberry (*Aronia melanocarpa*)

Boreal bog sedge (*Carex magellanica* ssp. *irrigua*)

Greater bladderwort (*Utricularia macrorhiza*)

Mountain holly (*Nemopanthus mucronatus*)

Northern white cedar (*Thuja occidentalis*)

Northern wild raisin (*Viburnum nudum* var. *cassinoides*)

Round-leaved sundew (*Drosera rotundifolia* var. *rotundifolia*)

Tawny cotton-grass (*Eriophorum virginicum*)

Three-seeded sedge (*Carex trisperma*)

Tussock cotton-grass (*Eriophorum vaginatum*)

Tussock sedge (*Carex stricta*)

White beak-rush (*Rhynchospora alba*) –

White fringed orchis (*Platanthera blephariglottis* var. *blephariglottis*) –

Sources: Wu and Kalma (2011), Eastman and Hansen (1995), Cox (2002)

Amphibians

◀ = Vocalization information (call period dates are for Northern NY)

Target Species:

NOTE: Descriptions and photos are shown for two species. The other entries will be completed for a future version of the handbook. You will learn how to identify target species during training sessions.

American Bullfrog (*Lithobates catesbeianus*)

American Toad (*Anaxyrus americanus*) – A common brown or tan toad found in forests and grassy areas throughout NY state and the Adirondack Park. Has brown warts with black borders on back and legs. Belly is smoother, often with spots.

◀ Call: A long, constant buzzing trill mostly on one pitch.
Heard from late April through mid-to late July.

Green Frog (*Lithobates clamitans*)

Gray Tree Frog (*Hyla versicolor*)

Mink Frog (*Lithobates septentrionalis*)

Northern Cricket Frog (*Acris crepitans*)

Northern Leopard Frog (*Lithobates pipiens*) – a medium-sized frog found in grassy areas throughout NY state north of New York City and Long Island. Grayish brown body with rounded, dark spots with whitish edges.

◀ Call: A buzzing snore followed by a series of clicking and clucking grunts.
Heard from early April to late May.

Pickerel Frog (*Lithobates palustris*)

Spring Peeper (*Pseudacris crucifer*)

Western Chorus Frog (*Pseudacris triseriata*)

Wood Frog (*Lithobates sylvaticus*)

Additional NY Species:

Eastern Spadefoot (*Scaphiopus holbrookii*) – toad found mainly on Long Island (not in the Adirondacks).

Fowler's Toad (*Anaxyrus fowleri*) – found mainly in the Hudson River valley and in southern NY and Long Island.

Southern Leopard Frog (*Lithobates sphenocephala*) – found in southern NY and on Long Island.

Source: Gibbs et al. (2007)

Birds

◀ = Vocalization information

Target Species:

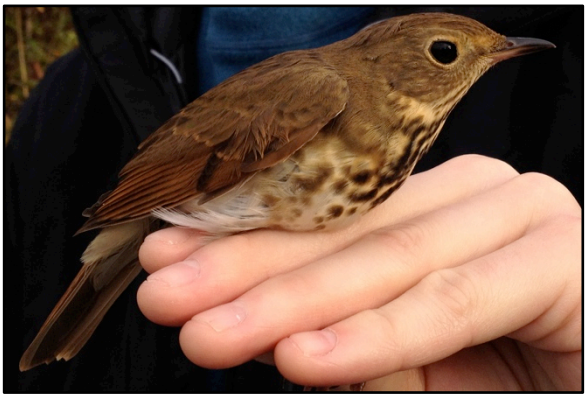
NOTE: Descriptions and photos are shown for two species. The other entries will be completed for a future version of the handbook. You will learn how to identify target species during training sessions.

Black-capped Chickadee (BCCH) – a small, lively bird with a black crown and throat, white nape, gray wings, and a light gray/white belly. Chickadees are commonly seen flitting around in the branches of trees and shrubs looking for insects or seeds. They often travel in groups.

◀ Song: A high, clear "fee-beeyee" with first note higher than the second note
Call: A chattering "chikadee dee dee dee"

Blue Jay (BLJA)

Common Yellowthroat (COYE)



Hermit Thrush (HETH) – a robin-sized bird that often forages in the forest understory for invertebrates. Light brown above with black breast spots on a white belly. Tail is rufous (reddish-brown).

◀ Song: A liquidy flutelike song beginning with a long whistle and followed by 2-3 bubbly phrases that fade away at the end.
Call: A simple, soft "chup"

Least Flycatcher (LEFL)

Lincoln's Sparrow (LISP)

Nashville Warbler (NAWA)

Olive-sided Flycatcher (OSFL)

Purple Finch (PUFI)

Swamp Sparrow (SWSP)

White-throated Sparrow (WTSP)

Winter Wren (WIWR)

Additional "Expert" List:

Alder Flycatcher (ALFL)

Bay-breasted Warbler (BBWA)

Black-backed Woodpecker (BBWO)

Blackpoll Warbler (BLPW)

Brown Creeper (BRCR)

Canada Warbler (CAWA)

Cape May Warbler (CMWA)

Carolina Wren (CAWR)

Chestnut-sided Warbler (CSWA)

Gray Jay (GRAJ)

Magnolia Warbler (MAWA)

Palm Warbler (PAWA)

Pine Siskin (PISI)

Rusty Blackbird (RUBL)

Spruce Grouse (SPGR)

Tennessee Warbler (TEWA)

Three-toed Woodpecker (TTWO)

White-winged Crossbill (WWCR)

Yellow-bellied Flycatcher (YBFL)

Yellow-rumped Warbler (YRWA)

Source: Sibley (2003)

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Project Contacts:

David Patrick
Center for Adirondack Biodiversity
Paul Smith's College
Routes 86 and 30, Paul Smiths, New York 12970
Phone: 518-327-6174 Email: dpatrick@paulsmiths.edu

Paul B. Hai
Adirondack Ecological Center of SUNY College of Environmental Science and Forestry
6312 Route 28N, Newcomb, NY 12852
Phone: 518-582-4551 x104 Email: pbhai@esf.edu

Additional contact information and online resources will be communicated to citizen scientists as they appear. Please stay tuned!

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