

UrbanWatch

BIODIVERSITY URBAN SURVEY

The term *biodiversity* is used to describe “the diversity of life on earth, reflected in the variety of ecosystems and species in their processes and interactions (World Wildlife Fund).” For example, a city park containing dozens of plant species, as well as habitat for various species of birds, mammals, reptiles, amphibians and insects, has a higher biodiversity than a corporate office park dominated by turf grass, ornamental trees and shrubs. *Urban biodiversity* refers to the variety of species in urban natural areas. Biodiversity has significantly declined in many urban areas where decades of development have compromised the land’s ability to support a diverse mix of plants and animals.

To most city dwellers, the concept of urban biodiversity seems an immediate contradiction in terms. In fact, however, our cities are interspersed with environments in which nature not only persists, but thrives – cemeteries and golf courses, back yards and empty lots, parks and corporate campuses, tree-lined residential streets and railroad rights-of-way. The adaptable plants and animals that inhabit cities can be just as interesting as those in more exotic places.

Urban environments tend to favor generalist species – species able to take advantage of varied environments. Some animal species have so successfully exploited the urban environment that you can see them virtually everywhere you look.

For some species, urban natural areas are an important refuge. A backyard with specific plants can be a rich sanctuary for butterflies. Thousands of migrating birds find city parks, corporate office campuses, and forest preserves to be life-sustaining oases on their annual migrations.

Nature is also a refuge for one other species that lives in cities – people. People who once accepted cities of concrete now increasingly ask for green and growing ones.

Scientists have identified specific taxonomic groups native to Illinois that serve as signs of habitat quality. Because urban systems have literally been superimposed on native landscapes, any native biota remaining after extensive urbanization can serve as indicators that at least partial ecological functioning of the previous landscape is underway. Even where humans impose their will upon the land and drastically alter the original landscape, ecosystems still behave according to nature’s checks and balances, regardless of what organisms or structural changes have been introduced.

UrbanWatch focuses on the creation of biodiversity profiles for given sites. This approach is accessible to beginners. After a suitable green space has been identified and characterized, a seasonal survey is used to identify the presence of selected native plants and animals at the site. This survey is called a Biodiversity Urban Survey (BUS).

GETTING STARTED

Good preparation is the key to successful monitoring.

1. Review

Prior to monitoring your site, it is important to thoroughly review training resources.

2. Select a Green Space Location

Using a detailed map of your community, identify potential monitoring areas. Acceptable monitoring areas include parks, cemeteries, school and commercial office campuses, golf courses, community gardens, boulevard parkways, back yards and empty lots. Record the name of the area, the street address, and street boundaries. If no name exists for your site, create your own based on a nearby landmark, local street names or some other reference familiar to you and your monitoring group. Use of Global Positioning System (GPS) equipment can more accurately help you and others find the location of the site on subsequent visits. Record that information, if you have it, on your Site Survey Data Sheet.

Community green space maps are one of many tools you can employ to identify a good monitoring area. Talking with local residents and exploring your community by car or on foot are still the best ways to locate a good monitoring area.

3. Select a Monitoring Site

Once a suitable monitoring area is selected, a well-defined monitoring site must be chosen within that space. For smaller green spaces, the monitoring site may encompass the entire area. For larger ones selection of a smaller space with easily recognized boundaries should be identified. Follow these steps to select your monitoring site.

- **Walk your green space.** Visit your selected green space and walk the entire area. As you walk the area, take note of the different types of habitat, as well as major landmarks and other permanent features that might serve as good site boundaries. Good boundary markers include hedge rows, sidewalks, large trees or rocks, light poles, sign posts and driveways.
- **Identify a monitoring section.** Once you are familiar with which habitats are present, identify a specific section to monitor. Your site should be a continuous area that contains a variety of habitats and can be monitored within an hour. The size of a typical monitoring site is approximately 150 paces by 150 paces for a team of three to five students. The size and shape of your monitoring site will vary depending on the number of persons conducting the monitoring. However, once the monitoring site is established, it will not change from year to year.

When selecting a site remember these considerations:

- **Access.** Permission to access the site will be needed from the landowner or land manager prior to monitoring.
- **Safety.** Keep traffic, topography and public safety in mind to ensure the safety of your group.
- **Size.** Be sure the size of the site is adequate for your group. A team of three should not attempt to monitor sites larger than 150 x 150 paces in area. Larger groups (six or more) can cover larger sites in a single hour.
- **Habitat.** Each species of plant, fungi or animal has its own preferred habitat. Select areas that contain these habitats, if possible

Figure 1 illustrates the selection of a typical monitoring area and site. *Taylor Park* has been identified on the city map as a potential monitoring area. It is bounded by Berkshire Street on the north, Cuyler Avenue on the east, Division Street on the south and Elmwood Avenue on the west. The park occupies an entire city block – too large for the team that intends to monitor the site – so a smaller area in the southeast corner is chosen as the actual monitoring site.

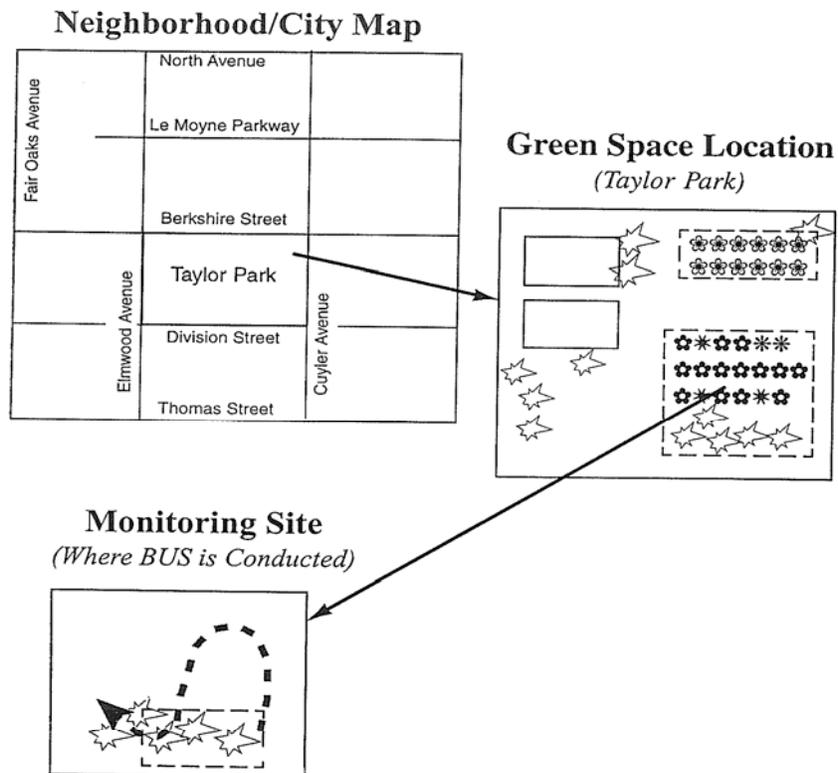


Figure 1 – Sample Green Space Map

4. Obtain Property Access Permission

Prior to monitoring, it is necessary to obtain permission to access the site. Begin by identifying and contacting the landowner. To identify a landowner, contact a local chamber of commerce, neighborhood block club, alderman or city council person, or local school official.

While most publicly owned properties such as parks or cemeteries are open to the public, access may be limited to certain hours. Moreover, many of these areas, such as county forest preserve districts or nature preserves, may require special permits for conducting scientific studies on the property. Always contact the site supervisor or land manager to obtain the proper permit for your site.

Carry personal identification and copies of any required permits with you while conducting fieldwork, in case police or other officials should ask what you are doing. Even where there are no access restrictions and no permit requirements by the land manager, you should always carry a signed property access agreement form with you while you monitor.

Prior permission to monitor is mandatory for all privately owned monitoring sites. A letter granting such permission should specify the owner's name, the location of the property, which persons or groups have permission to use the property and for what period of time. A sample Property Access Agreement Form for both private and public lands can be found in Appendix B.

Safety and Other Precautions

Keep the following notes in mind to ensure a safe and comfortable monitoring experience. Remember, your safety is far more important than the data you collect.

Wear light-colored clothing – many insects, including mosquitoes, are attracted to dark colors, particularly red and black. Use insect repellent to help keep mosquitoes, ticks, and other pests from biting you.

Be careful of steep or variable terrain, or various objects which may be dangerous, such as fallen trees, holes, or human artifacts (old fences, broken glass, etc.).

Never monitor when there is lightning or thunder. If the weather conditions worsen while you are outside, finish what you can before conditions become bad and seek shelter. Never stand in the open, under an isolated tree, or in water during periods of lightning.

Things to Bring:

- ✓ Insect repellent
- ✓ Water bottle
- ✓ Rain gear
- ✓ First aid kit

Beware of potentially harmful animals, including mosquitoes, biting flies, bees and wasps. Some animals – such as stray cats or dogs – may not appear dangerous but should still be avoided. Cats, dogs and even squirrels can carry rabies and other harmful diseases. It is best to observe animals, not touch.

Be considerate of other persons using the area for recreation or other purposes. Do not harass animals or disturb plants living on the site. Put litter in its place, but leave anything questionable alone.

Avoid suspicious-looking persons. If you feel unsafe or anyone makes you feel uncomfortable, stop your work immediately and go someplace safe. Avoid working alone and in areas where others cannot see you.

Always monitor with a partner or a group. Notify someone where you are going and when you plan to return. Take at least one cell phone with you and make sure the battery is charged. In case of emergency, know where to access a phone and emergency fire, police, or medical help.

IN THE FIELD

Prior to monitoring, it is important to document key information regarding the site you plan to monitor. This section explains how to characterize and sketch your monitoring site.

Tasks

To select a monitoring site from green space in your community. To draw a detailed map of your monitoring site.

Materials

- Maps of the area
- *UrbanWatch Manual*
- Copy of access permission letter or monitoring permit
- Copy of Site Survey Data Sheet
- Copy of Site Sketch Data Sheet
- Pencils/Pens

Procedure

A description of the habitat(s) and structure of each monitoring site should be the first item recorded. The condition of the site and its surroundings can influence the plants and animals found at your site. Information on the site's physical structure (e.g., trees vs. shrubs vs. open area) will help explain the presence or absence and the distribution of organisms at each individual site.

Site Survey

The habitats present at your monitoring site, including the area immediately surrounding your site, are described using the Site Survey Data Sheet, which is in Appendix C.

The Site Survey Data Sheet has four parts. See Figure 2 for an example of a completed Site Survey Data Sheet.

SITE SURVEY DATA SHEET

Group Name: ECP Club Date: 9/26/99
 Names of Monitors: Andrea Loggen, Chris Holvach, Michelle Oakley, Shelby Fuller, Jessica Stephens

1. Location Characterization
 Green Space Name: Taylor Park
 City: Oak Park
 Address or Major Interconnection: bordered by Berkshire St, Division St, Elmwood Ave, Cuyler Ave.
 Description of Monitoring Site boundaries within Green Space: SE corner of site park, near intersection of Division St + Cuyler Ave.
 Property ownership: Public Property, Private Property, Other
 Property Contact Name: Bob Doe Contact Phone Number: 312-999-9999

2. Site Configuration (recorded once)
 a. Shape of site. Check one. square, round, rectangular, other _____
 b. Area of site 100 meters X 150 meters.
 If you measured your site in paces, please convert to meters by marking off 1 pace along a meter stick: 1 pace = _____ meters
 c. Site Type: Schoolyard, Backyard, Park, Corporate Campus, Cemetery, Boulevard, Vacant land / abandoned lot, Other _____

3. Physical Description
 a. Site Structure Description (Fill in ALL blanks)
 Percentage of site covered by:
 Trees (linear 0 % vs. clumped 3 %); Grass 70 %; Shrubs 5 %;
 Logs 0 %; Rocks 0 %; Asphalt/Concrete 5 %; Water 0 %;
 Multiple Woodchips 10 %; Other 0 % Please describe _____
 b. General topography of site flat, sloped, hilly. Check one.

c. Description of area surrounding the survey site
 1. Proximity to natural area. Check one. < 100m, 100-500m, > 500 m
 Type: None
 2. Proximity to road. Check one. < 100m, 100-500m, > 500 m
 Type of road: city street
 Size of road 1 lanes in each direction
 3. Salt usage. Check one. heavy, light, none.
 4. Proximity to water. Check one. < 100m, 100-500m, > 500 m
 Source: lagoon, pond, stream, bin/huuh, fountain, other _____
 5. Proximity to buildings. Check one. < 100m, 100-500m, > 500 m
 Type: homes, office, industry, other _____

d. Maintenance of Site
 1. How often is the site: Mowed? twice/week Trampled? daily Planted? seasonally
 2. Are pesticides used at the site? yes, no Check one.
 If yes, how often? _____
 3. Are herbicides used at the site? yes, no Check one.
 If yes, how often? _____
 4. Is conservation action taking place at the site? yes, no
 If yes, please describe _____
 e. Amount of sunlight the site receives: full, partial, none Check one.
 f. Latitude 41.9030 N Longitude: -87.795 W
 Source of data: USGS Topographic Map
 * go to www.maphunt.com/myblast/blastx.asp to get your latitude and longitude using your street address
 g. Census information (OPTIONAL): 506 Yr Residents in Oak Park
 4. General Notes and Observations:
 Please use this area to note anything that has not been covered by the Site Survey Data Sheet, including changes in your site since the last visit. Be as specific and detailed as possible.
Lots of kids playing a running around, trampling grass. Paper binders on ground. Dog wastes all over. Lots of trash (beer bottles) by hedge row near fence. Aphids across flowers, had not on Green Space. Maintenance info from Chicago Park District (land manager).

Figure 2. Completed Site Survey Data Sheet

1. Location Characterization

On a copy of the Site Survey Data Sheet, record basic identifying information such as the name and address of your monitoring location, the names of people doing sampling, and information about the owners of the property. Also include a description of the site boundaries within your urban green space. If your green space does not have a name by which it is commonly known, give it one, making sure to use the same name on all data sheets. Add GPS information, if you have access to it.

2. Site Configuration

Next, define and measure your monitoring site.

- Gather as many maps of the area as possible.
- Categorize your site as one of the following types: backyard, schoolyard, park, cemetery, boulevard, or corporate campus. If your site does not fit one of these types, categorize it as “Other” and write in the type that best fits your site.
- Determine the shape and dimensions of your site and record the information on the Site Survey Data Sheet.

3. Physical Description

Note the physical description of the monitoring site by filling in the blanks on the Site Survey Data Sheet as indicated.

- **Surface Structure:** You will be sampling from the part or parts of your site that have the most varied habitats. To identify those parts, determine how much of the site’s surface is covered by various kinds of vegetation or artificial surfaces. Estimate the proportion of the site’s total area that is covered by each type of land cover – 30% grass, 10% trees, and so on. Remember to fill in **all** blanks.
- **General topography of the site:** Note whether the site is flat, sloping or hilly on the Site Survey Data Sheet. If your site’s topography is variable, select the term that is most indicative.
- **Description of surrounding area:**
 - ◇ Proximity to natural area and type (park, garden, etc.)
 - ◇ Proximity to road, type (gravel, highway, city street, alley, etc.) and size
 - ◇ Salt usage (heavy, light, none)
 - ◇ Proximity to water source and type (river, lagoon, pond, birdbath, fountain, other)
 - ◇ Proximity to buildings and type (homes, offices, industry, other)
- **Maintenance of site:** Note how often site is mowed, trampled and planted, as well as pesticide/herbicide usage. This information is best obtained from the site’s owner or land manager.
- **Conservation Action:** Note if the site is undergoing any types of activities which promote biodiversity or the quality of the green space. Planting native trees and plants is an example of conservation action.
- **Amount of sunlight**
- **Latitude and longitude** of your site: Procure this information for your monitoring site, not the entire green space.

4. General Notes and Observations Be as specific as possible, and include any variables that may influence the biodiversity at your site.

Site Sketch

Sketch your site on a copy of the Site Sketch Data Sheet, found in Appendix C. See a completed example in Figure 3.

SITE SKETCH DATA SHEET

Name: _____ Date: _____ Site Name: _____

1. Walk your green space and assess habitat distribution.
2. Identify a monitoring site area.
3. Mark your site with flags.
4. Sketch an aerial view of your site. Be sure to mark the direction of NORTH. Draw and label shrubs, trees, ponds, pavement, grass, roads, walkways and other landscape features. Indicate the dimensions of your site in meters. Write notes and observations on the bottom or back of this data sheet.
5. Draw your Biodiversity Route in enough detail so that future observers will be able to follow the same route in subsequent visits.
6. Determine your Biodiversity Route based on maximum habitat diversity and draw it on your site sketch. Include enough detail for other observers to follow the same route in subsequent visits.

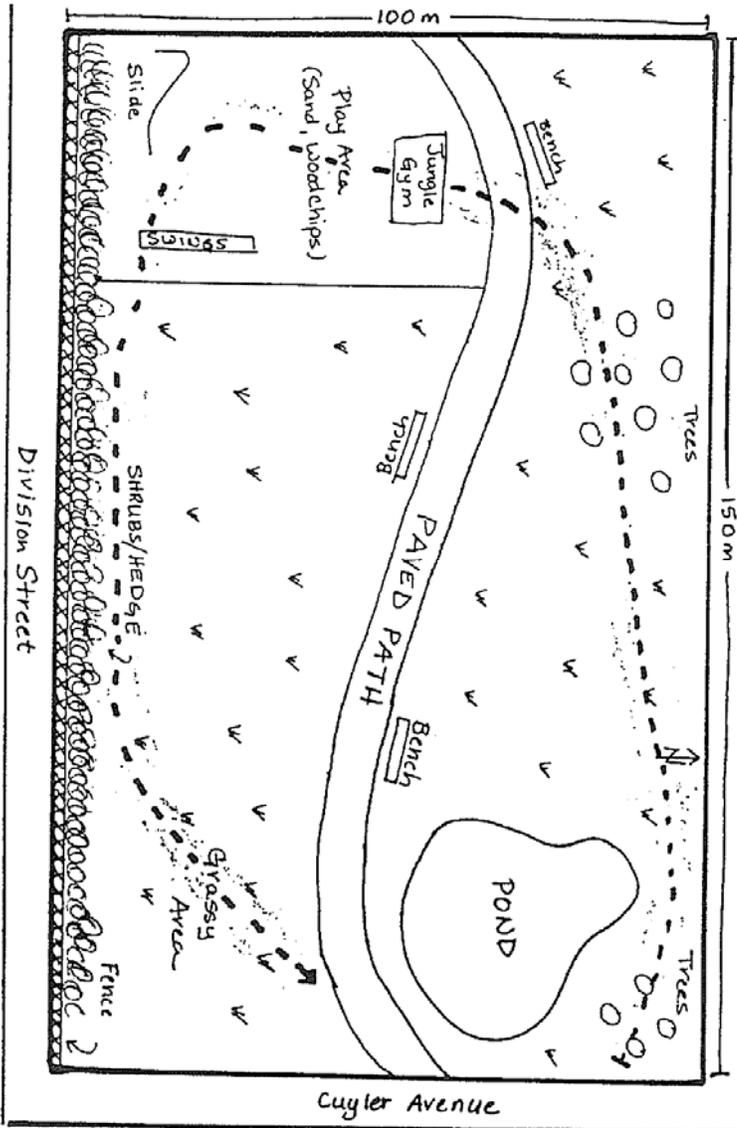


Figure 3. Sample Site Sketch

Once you arrive at your monitoring site, start at one corner and walk over the entire site, mentally noting the landscape. Then, walk through the site again and start sketching the different features. If the site is very large, split it into parts, and sketch each part separately. Note the location of the streets and other boundaries. Draw any buildings, parking lots, paths, and other features that are on the site, showing their location and size relative to each other and to the site as a whole. Also, sketch where various kinds of vegetation are growing – grass, trees, and shrubs – plus areas containing water – streams, lagoons and ponds.

Visit Log

Fill out a Visit Log (Appendix C) each time you visit your site to gather data. See Figure 4 for a completed example.

VISIT LOG

Site Name: Taylor Park Date: 9/26/99
 Group Name: ECP Club Season: Fall
 Start Time: 1:05 pm Total Time Elapsed: 65 min.
 End Time: 2:10 pm

1. Identify which survey is being conducted. (CIRCLE one)

BUS OR BLOCK

2. If a BLOCK is being conducted, identify which Target Organism is being monitored (circle one)

Birds Butterflies Mushrooms & Other Fungi
 Rove & Carrion Beetles Snails & Slugs Tiger Beetles Tree Health

3. Names of Monitors: Please list your group leader or teacher first.

Andrea Lofgren, Michele Oakley, Shelly Fuller, Jessica Fuller

4. Weather Conditions Today

RAIN	TEMPERATURE	SKY CONDITIONS	WIND
<input checked="" type="checkbox"/> None	<u>76°</u> High for monitoring day (F)	<input type="checkbox"/> Clear	<input type="checkbox"/> Calm
<input type="checkbox"/> Light	<u>52°</u> Low for monitoring day (F)	<input checked="" type="checkbox"/> Partly cloudy	<input checked="" type="checkbox"/> Light breeze
<input type="checkbox"/> Moderate	<u>74°</u> Monitoring temperature (F)	<input type="checkbox"/> Overcast	<input type="checkbox"/> Windy
<input type="checkbox"/> Heavy			

5. Weather Conditions Yesterday

RAIN	TEMPERATURE	SKY CONDITIONS	WIND
<input type="checkbox"/> None	<u>74°</u> High for yesterday (F)	<input type="checkbox"/> Clear	<input type="checkbox"/> Calm
<input checked="" type="checkbox"/> Light	<u>52°</u> Low for yesterday (F)	<input type="checkbox"/> Partly cloudy	<input checked="" type="checkbox"/> Light breeze
<input type="checkbox"/> Moderate		<input checked="" type="checkbox"/> Overcast	<input type="checkbox"/> Windy
<input type="checkbox"/> Heavy			

6. Weather Conditions Compared to the Average for this Time of Year (use almanac or newspaper)

Actual Precipitation for monitoring month to date:	Average Precipitation for monitoring month to date:	Average Temperatures on this date:
<u>2.3</u> inches	<u>3.7</u> inches	<u>69°</u> Average High (F)
		<u>50°</u> Average Low (F)

Figure 4. Completed Visit Log

Biodiversity Urban Survey (BUS)

Biodiversity Urban Surveys are general surveys intended to identify the presence or absence of native plants, fungi, and animals most likely to be observed at a given urban monitoring site. Since BUSes are conducted throughout the year, taxon lists for the BUS will vary according to the season during which it is conducted. This “general inventory” will help create a biodiversity profile for the site.

Because the BUS is designed to be a *general survey*, you will not need to record the presence of every species or individual, even if it is native to Illinois. Some taxa may not be on the BUS list because they do not provide significant information on habitat quality. Others that are present may not be covered by your BUS route on your monitoring site.

While some plants and animals are not direct indicators of overall ecosystem health, in urban settings they can be descriptive of overall diversity and give a hint about urban habitat quality. Document the presence/absence and numbers of the selected taxa (by season) that are within five meters of a defined route.

Each season has a unique BUS taxa list based on which taxa are most likely to be present at a given time of the year. Seasons are delineated as follows:

Spring	April 1 – May 31
Summer	July 1 – August 31
Fall	October 1 – November 30
Winter	January 1 – February 29

These months were chosen to reflect the range of seasonal variation throughout the state, and to minimize sampling in months of transition between seasons. Seasonal species lists are located in Appendix D.

Materials

- Signed Property Access Agreement Form
- Watch or timer
- Clipboard
- Thermometer
- Pencil/Pen
- Hand lens
- Garden trowel
- Binoculars
- Forceps
- Completed Site Sketch Data Sheet
- Biodiversity Taxa List (for appropriate season)
- Biodiversity Taxa Checklist
- Diversity Index Data Sheet
- BUS Taxa Data Sheets

Monitoring Preparation

Review and become familiar with the appropriate BUS taxa. Also focus on ways to distinguish these species from other organisms.

Always fill out a Visit Log before you conduct the survey (see Appendix C). The BUS procedure may be conducted by a small group (3-5 people) or by a class of students (~30).

Table 1. Where to Look for BUS Taxa

Amphibians & Reptiles	In moist soils under fallen trees In leaf litter Near lagoons, rivers or ponds	
Birds	In trees In shrubs In tall grasses In the open air	
Fungi	At the base of trees or tree stumps In wood and woodchips In lawns In dead hardwood trees	In areas with reworked, turned, or compacted soil
Insects & Arachnids	In sand or clay near water bodies Along shaded paths and logs In moist soils along riverbanks, mudflats, sandbars and lakes Near steady supply of rotting carrion In sand dunes Near compost heaps	In grassy areas Along roadsides At stream edges At forest edges In woodlands Near flowering plants In gardens
Mammals	Near sheltered areas like shrubs In holes and burrows In trees In gardens	
Plants	In gardens Along paths, trails, and railroad tracks In non-maintained or non-groomed areas	
Snails & Slugs	In gardens Under rotting wood In woodchips	Near or in rocks In leaf litter
Trees	In open spaces	

3. Walk the route

Begin slowly walking the designated route at 1 mph, which is approximately 1/2 the pace of normal walking. BUS walks should be roughly 1 hour and approximately 1 mile in length. On smaller sites, the length of the walk can be dictated by the size of the site.

4. Identify organisms

As you walk the entire route; **identify** the BUS organisms that are *within* the route corridor – 5 meters on either side of your path. Each taxon is assigned a letter and a number. The assigned letter depends upon which of the following groups it falls into: Amphibians & Reptiles, Birds, Fungi, Insects & Arachnids, Mammals, Plants, Snails & Slugs, or Trees. The assigned number depends upon what order it is listed on the rapid identification card. For example, the code for a Crab Apple tree is **T3** and the code for a Common Crow is **B5**. Any species not listed in the Biodiversity Taxa List should be recorded in the “Other” section at the bottom of the **BUS Taxa Data Sheet**.

5. Record taxa codes

On the BUS Taxa Data Sheet chart, record the taxa codes in the order in which all the plants and animals were *reached*. For example: Blue Jay – B2; Hackberry – T5; Coneflower – P3; Tiger Beetle – I4. See Figure 6 for an illustration of this recording technique. This information will be needed later to calculate the Biodiversity Index for the site.

Make sure you are not recording the same individual organism over and over. **Pay attention** to what the other monitors are saying to ensure that you do not double count individuals.

When you encounter a group or clump of selected taxa, it is **important to record each distinct plant, fungus, or animal**. If each individual is not recorded, your later calculations will be skewed.

6. Record end time

Record the end time and calculate the total amount of time for the walk.

Remember; never hesitate to **keep notes** about any unusual occurrences, uncertain identifications or biological events. For example, you should record observations such as encountering an insect on the flowers of a garden plant or finding a dead animal.

Biodiversity Index

Diversity is a measure of the number of species that inhabit a given area. The Overall Diversity Index is a calculation that has been developed to compare habitats, and it is used in UrbanWatch to encapsulate Biodiversity Urban Survey (BUS) data. What does an Overall Diversity Index number mean? The higher the number generated, between 0 and 1, the more diverse a particular habitat is.

Taxa Code →	B2	T5	P3	I4	P3	P3	P3	I4	I4	I4	I4	I4	T5	T5	T5
Sequence Order →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	T5	T5	F2	F2	F2	F2	P3	P3	P3	B2	B2	B2	I4	I4	I4
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	I4	I4													
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45

Figure 6. Sample BUS Data

Example: How to Calculate the Overall Diversity Index

1. In Taylor Park, different individuals from the Fall BUS Taxa List are found along a BUS route. The results of this route and identification are recorded on the data sheet as shown in Figure 6.
2. First record the Total Number of Individuals encountered. (Thirty-two individuals were identified on this route.)
3. Next figure out the Total Number of Taxa Represented and record this result on the Diversity Index Data Sheet. You may wish to use the Biodiversity Taxa Checklist (Appendix C) to assist you. (A total of five species are represented.)
4. Next count the number of consecutive occurrences (runs) of a taxon. To do this, draw a line above or below each identical taxa code, as in Figure 7. Calculate the total number of runs by counting the lines. For example, the data listed in Figure 7 translate into a sequence of runs shown below the chart. The total number of runs is 11.
5. The formula below is used to determine the site's Habitat Complexity Index, which should be recorded on the Diversity Index Data Sheet.

$$\text{Habitat Complexity Index (DI}_R) = \frac{\text{\# of Runs}}{\text{Total \# of Individuals}} \qquad \text{DI}_R = \frac{11}{32} = 0.34$$

6. The Taxa Richness Index takes into account the distribution of different types of taxa which were monitored. Record the Taxa Richness Index value on the Diversity Index Data Sheet.

$$\text{Taxa Richness Index (DL}_T) = \frac{\text{\# Taxa}}{\text{Total \# Runs}} \qquad \text{DL}_T = \frac{5}{11} = 0.45$$

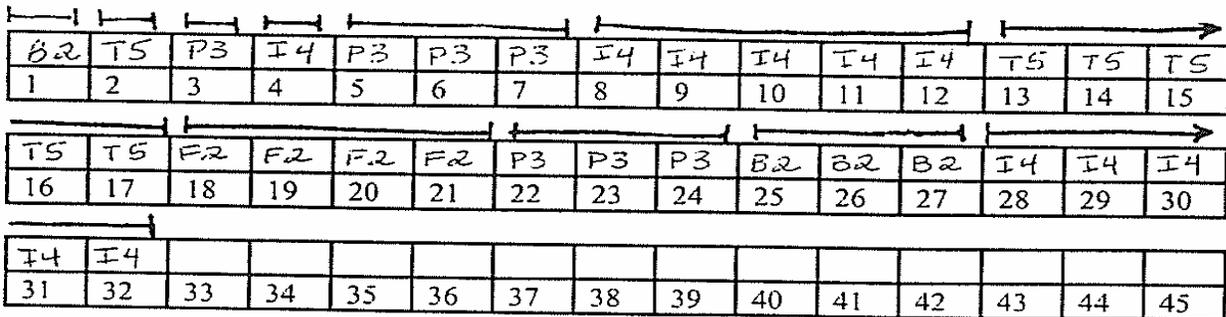


Figure 7. Sample BUS Data with Runs Marked

The information in the above chart translates into this sequence of runs:
B2 T5 P3 I4 P3P3P3 I4I4I4I4 T5T5T5T5T5 F2F2F2F2 P3P3P3 B2B2B2 I4I4I4I4
 The total number of runs is 11.

7. The Overall Diversity Index is the final number one must compute. Put simply, the Overall Diversity Index is calculated by multiplying the Habitat Complexity Index and the Taxa Richness Index and taking the square root of that product. Record this value on the Diversity Index Data Sheet.

$$\text{Overall Diversity Index } (DI_o) = \sqrt{DI_R (DI_T)}$$

$$(DI_o) = \sqrt{(0.34) (0.45)} = \sqrt{0.15} = 0.39$$

Procedure Summary: Biodiversity Urban Survey

This section provides a step-by-step review of monitoring.

Getting started

1. Review tutorial, monitoring manuals, and other training resources
2. Select a green space location
3. Select a monitoring site
 - Walk your green space
 - Identify a monitoring section
4. Obtain access permission
 - Contact landowner for permission
 - Carry access permission form and/or monitoring permit with you at all times

In the Field

1. Complete Site Survey Data Sheet
 - Fill out Location Characterization
 - Complete Site Configuration
 - Complete Physical Description
 - Record General Notes and Observations
2. Complete Site Sketch Data Sheet
 - Include roads, vegetation types, and other features
3. Complete Visit Log
4. Gather equipment and copy data sheets
5. Conduct BUS
 - Choose a Biodiversity Urban Survey route and mark it on your site sketch
 - Record start time
 - Walk the Route
 - Identify organisms
 - Record taxa codes
 - Record end time
6. Complete Biodiversity Index

Appendix A Monitoring Tips

Suggestions for Monitoring with Large Groups

Suggestions for classes or large groups on a large site:

On large sites, it may be feasible to divide the monitoring site into units, allowing smaller groups to monitor along multiple BUS Routes.

- Pick a large site that is suitable for the number of people monitoring.
- Assign the participants into teams of 4-5 people. Designate a recorder for each team and allow the other team members to function as observers.
- Assign each group a unique plot within the total area, making sure the plots do not overlap. Follow the normal BUS procedures.
- To produce the biodiversity indexes for the full site, average the Total Number of Individuals, Total Number of Species Represented, and the Total Number of Runs for all groups. Calculate the Indexes based on your averaged values.

Suggestions for assigning roles to individuals in large groups:

A group of 20-30 students monitoring at the same time can be cumbersome. Monitoring may go more smoothly if different roles are assigned to small groups or individuals. This is especially important if a site is too small to be subdivided.

- As a class, quickly determine your site's boundaries and determine your BUS route.
- Select one group of monitors (no more than 6-8 people) to begin collecting data. Within that group, delegate one person to record data as it is called out. Have another person regulate walking speed and ensure that everyone stays within the 10 m-wide route. Monitors may also be assigned specific monitoring goals: direct some to observe the ground for fungi or snails, others to look for birds and butterflies, etc. Follow all BUS procedures.
- Allow a second group of monitors to complete the Site Survey Data Sheet.
- Appoint a third group to the Site Sketch Data Sheet. Make sure they communicate with the monitoring group in order to accurately record the BUS route.
- Direct a fourth group to fill out the Visit Log.
- Reconvene after monitoring to determine the diversity indexes and complete the Diversity Index Data Sheet.

Suggestions for School Groups Monitoring over *Multiple Class Periods*

- Divide up the data sheets so that each class has a specific role.
- Assign the Site Survey Data Sheet to one class. Discuss the different habitats present and determine a site that maximizes the habitat diversity. Mark the site with flags.
- Allow the second class to draw the site sketch and determine the BUS route. Discuss possible BUS routes and reach a consensus as a class. Draw the route onto the site sketch.

- Have the third class fill out the Visit Log and perform the monitoring. Divide the class into two groups. Allow one group to fill out the Visit Log while the other students walk the route and record data on the BUS Taxa Data Sheet in accordance with the procedures.

It is imperative that the Visit Log be completed just before or while monitoring.

Frequently Asked Questions

1. I want to monitor on a site that is not 10 meters wide. Do I need to find a bigger site?

If a site is not wide enough to accommodate the 10 m-wide route, you may monitor the width of the site. However, make sure to record this deviation from the normal protocols on your data sheets and follow all other procedures.

2. If I see a bird flying overhead of my urban green space, should I record it in my BUS sequence? What if I only hear the bird?

You may only record an organism in your BUS sequence if it passes through your 10 m-wide route. If it is merely present on your site but not within your route, record it in the “Other Taxa Found” section at the bottom of your BUS Taxa Data Sheet.

If you hear a bird or other animal within your BUS Route but cannot see it due to an obstructed view, you may record it in your BUS sequence *if* you are able to accurately identify it. Otherwise record it in the “Notes” section at the bottom of your BUS Taxa Data Sheet.

3. Do I record tracks or other evidence of animals, such as nests or spider webs?

Tracks, nests, and webs should not be recorded in your BUS sequence since it is difficult to determine when they were left. However, they do provide evidence of biodiversity and should be recorded in the “Notes” section.

Appendix B

PROPERTY ACCESS AGREEMENT FORM

I, _____, agree to allow _____ to access my property
(property owner or manager) (individual or group name)
listed under "Site Address" for activities related to monitoring events.

The above-named individual or group has access to my property between the hours of _____ am/pm
and _____ am/pm on the date or dates indicated under "Access Dates" below. The size of the group is
not to exceed _____ people. I would prefer the group park at _____
and access the site via _____.

I understand that this is a voluntary and non-binding agreement, that I am not responsible for any damages
or injuries that occur during monitoring activities, and reserve my right as the legal owner/manager of the
property to revoke this agreement at any time. I also understand that the individual or group contact listed
below is responsible for informing all participants of the terms of this agreement and for ensuring
adherence to those terms. Further, it is understood that the individual or group contact listed below is
responsible for notifying me at least twenty-four hours prior to accessing the property.

_____ Site Address (street address, city, county)	_____ Access Dates
_____ Signature	_____ Signature
_____ Individual or group contact	_____ Property owner or manager
_____ Group name	_____ Address
_____ Address	_____ Address
_____ Address	_____ Phone number
_____ Phone number	_____ Email
_____ Email	_____ Date
_____ Date	

Appendix C
SITE SURVEY DATA SHEET

Group Name: _____ Date: _____

Names of Monitors _____

1. Location Characterization

Green Space Name _____

City _____

Address or Major Intersection _____

GPS Coordinates, if available _____

Description of Site Boundaries within Green Space _____

Property ownership _____

Property Contact Name _____ Contact Phone Number _____

2. Site Configuration (recorded once)

a. *Shape of site.* Check one. ___ square, ___ round, ___ rectangular, ___ other _____.

b. *Area of site.* _____ meters x _____ meters.

If you measured your site in paces, please convert to meters by marking off 1 pace along a meter stick:

1 pace = _____ meters

3. Physical Description

a. *Site Structure Description (Fill in ALL Blanks)*

Percentage of site covered by:

Trees (linear ___ % vs. clumped ___ %); Grass ___ %; Shrubs ___ %;

Logs ___ %; Rocks ___ %; Asphalt/Cement ___ %; Water ___ %;

Mulch/Woodchips ___ %; Other ___ % (Please describe)
_____.

b. *General topography of site* ___ flat, ___ sloped, ___ hilly. Check one.

c. *Description of area surrounding the survey site*

1. Proximity to natural area. Check one. ___ < 100 m, ___ 100-500 m, ___ >500 m
Type _____

2. Proximity to road. Check one. ___ < 100 m, ___ 100-500 m, ___ >500 m
Type of road _____

Size of road _____ lanes in each direction

3. Salt usage. Check one. ___ heavy, ___ light, ___ none.

4. Proximity to water. Check one. ___ < 100 m, ___ 100-500 m, ___ >500 m

Source ___ lagoon, ___ pond, ___ stream, ___ birdbath, ___ fountain, ___ other _____

5. Proximity to buildings. Check one ___ < 100 m, ___ 100-500 m, ___ >500 m

Type: ___ homes, ___ offices, ___ industry, ___ other (specify) _____

d. Maintenance of Site

1. How often is the site:
Mowed? _____ Trampled? _____ Planted? _____
2. *Are pesticides used at the site?* _____ yes, _____ no. Check one.
If yes, how often? _____
3. *Are herbicides used at the site?* _____ yes, _____ no. Check one.
If yes, how often? _____

e. Amount of sunlight the site receives _____ full, _____ partial, _____ none. Check one.

f. Latitude _____ *Longitude* _____
Source of data: _____

4. General Notes and Observations:

Please use this area to note anything that has not been covered by the Site Survey Data Sheet, including changes in your site since the last visit. Be as specific and detailed as possible.

SITE SKETCH DATA SHEET

Name: _____ Date: _____ Site Name: _____

1. Walk your green space and assess habitat distribution.
2. Identify a monitoring site area.
3. Mark your site with flags.
4. Sketch an aerial view of your site. Be sure to mark the direction of NORTH. Draw and label shrubs, trees, ponds, pavement, grass, roads, walkways and other landscape features. Indicate the dimensions of your site in meters. Write notes and observations on the bottom or back of this data sheet.
5. Draw your Biodiversity Route in enough detail so that future observers will be able to follow the same route in subsequent visits.
6. Determine your Biodiversity Route based on maximum habitat diversity and draw it on your site sketch. Include enough detail for other observers to follow the same route in subsequent visits.

VISIT LOG

Site Name: _____ Date: _____
Group Name: _____ Season: _____
Start Time: _____ Total Time Elapsed: _____
End Time: _____

1. Names of Monitors: Please list your group leader or teacher first.

2. Weather Conditions Today

RAIN	TEMPERATURE	SKY CONDITIONS	WIND
<input type="checkbox"/> None	<input type="checkbox"/> High for monitoring day (F)	<input type="checkbox"/> Clear	<input type="checkbox"/> Calm
<input type="checkbox"/> Light	<input type="checkbox"/> Low for monitoring day (F)	<input type="checkbox"/> Partly cloudy	<input type="checkbox"/> Light breeze
<input type="checkbox"/> Moderate	<input type="checkbox"/> Monitoring temperature (F)	<input type="checkbox"/> Overcast	<input type="checkbox"/> Windy
<input type="checkbox"/> Heavy			

3. Weather Conditions Yesterday

RAIN	TEMPERATURE	SKY CONDITIONS	WIND
<input type="checkbox"/> None	<input type="checkbox"/> High for monitoring day (F)	<input type="checkbox"/> Clear	<input type="checkbox"/> Calm
<input type="checkbox"/> Light	<input type="checkbox"/> Low for monitoring day (F)	<input type="checkbox"/> Partly cloudy	<input type="checkbox"/> Light breeze
<input type="checkbox"/> Moderate	<input type="checkbox"/> Monitoring temperature (F)	<input type="checkbox"/> Overcast	<input type="checkbox"/> Windy
<input type="checkbox"/> Heavy			

4. Weather Conditions Compared to the Average for this Time of Year (use almanac or newspaper)

Actual Precipitation for monitoring month to date:	Average Precipitation for monitoring month to date:	Average Temperatures of this date:
_____ inches	_____ inches	_____ Average High (F)
		_____ Average Low (F)

BUS TAXA DATA SHEET

Site Name: _____ **Date:** _____
Group Name: _____ **Season:** _____
Start Time: _____ **Total Time Elapsed:** _____ **End Time:** _____

BUS DATA

In the chart below, record the codes of all BUS taxa in the order in which they were found.

Taxa code -															
Sequence order -	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45

	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75

	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90

	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105

	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120

	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135

	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150

	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165

	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180

	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195

Other Taxa Found/Notes:

BUS TAXA DATA SHEET Page 2

	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210

	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225

	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240

	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270

	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285

	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300

	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315

	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330

	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345

	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360

	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375

	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390

	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405

Other Taxa Found/Notes:

BUS TAXA DATA SHEET Page 3

	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420

	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435

	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450

	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465

	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480

	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495

	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510

	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525

	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540

	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555

	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570

Other Taxa Found/Notes:

BIODIVERSITY TAXA CHECKLIST

Once you have completed the BUS Taxa Data Sheet, complete this form. This checklist is a simple way to find out how many different taxa were found at your site.

1. Place a \checkmark next to the taxa that were found during the BUS. Only one \checkmark is needed per line; this is not a tally system.
2. When all of the taxa are accounted for, count the number of \checkmark s and write the total at the bottom of this page. This number will be used to calculate the Taxa Richness Index (DI_T).

CODE	SPECIES	PRESENT	CODE	SPECIES	PRESENT
AMPHIBIANS & REPTILES			MAMMALS		
A1	Frog		M1	Chipmunk	
A2	Snake		M2	Coyote	
A3	Toad		M3	Fox	
A4	Turtle		M4	Mole	
BIRDS			M5	Opossum	
B1	Red-winged Blackbird		M6	Rabbit	
B2	Blue Jay		M7	Raccoon	
B3	Northern Cardinal		M8	Squirrel	
B4	Chickadee		M9	White-tailed Deer	
B5	Common Crow		M10	Woodchuck	
B6	Mourning Dove		PLANTS		
B7	American Goldfinch		P1	Aster	
B8	Common Grackle		P2	Cinquefoil	
B9	American Robin		P3	Coneflower	
B10	Swallow		P4	Fleabane	
B11	Woodpecker		P5	Goldenrod	
FUNGI			P6	Mayapple	
F1	Bracket Fungus		P7	Milkweed	
F2	Cup Fungus		P8	Monarda	
F3	Morel		P9	Spring Beauty	
F4	Mushrooms		P10	Sunflower	
F5	Puff Ball		P11	Trillium	
INSECTS AND ARACHNIDS			P12	Virginia Bluebells	
I1	Bumble Bee		SNAILS AND SLUGS		
I2	Carrion Beetle		S1	Slug	
I3	False Stag Beetle		S2	Cone-Shaped Snail	
I4	Tiger Beetle		S3	Disc-Shaped Snail	
I5	American Copper Butterfly		TREES		
I6	Angle Wing Butterfly		T1	Ash	
I7	Monarch Butterfly		T2	Cottonwood	
I8	Mourning Cloak Butterfly		T3	Crab Apple	
I9	Painted Lady Butterfly		T4	Elm	
I10	Sulphur Butterfly		T5	Hackberry	
I11	Swallowtail Butterfly		T6	Hawthorn	
I12	Dog Day Cicada		T7	Maple	
I13	Daddy-long-legs		T8	Oak	
I14	Grasshopper		T9	Redbud	
I15	Garden Spider		T10	Sycamore	
I16	Sheetweb Spider		T11	Walnut	
I17	Spittlebug				

TOTAL NUMBER of \checkmark or Different Taxa Represented: _____

DIVERSITY INDEX DATA SHEET

Your Name: _____ Date: _____
 Site Name: _____ Season: _____

A. Total Number of Individuals from BUS Taxa Data Sheet = _____

B. Total Number of Taxa Represented from Biodiversity Taxa Checklist = _____

C. Total Number of Runs from BUS Taxa Data Sheet = _____

INDEX EQUATIONS

YOUR CALCULATIONS

D. Habitat Complexity Index (DI_R) = $\frac{\text{\# of Runs}}{\text{Total \# of Individuals}}$ = $\frac{C}{A}$ $DI_R = \underline{\quad} =$

E. Taxa Richness Index (DI_T) = $\frac{\text{\# Taxa}}{\text{Total \# Runs}}$ $\frac{B}{C}$ $DI_T = \underline{\quad} =$

Overall Diversity Index (DI_O) = $\sqrt{DI_R (DI_T)}$ = $\sqrt{(D) (E)}$ $DI_O = \sqrt{(\quad) (\quad)} =$

Reminder: Your index values should all be decimals between 0 and 1.

APPENDIX D SPRING BUS TAXA

Amphibians & Reptiles

- A1. Frog
- A2. Snake
- A3. Toad
- A4. Turtle

Birds

- B1. Red-winged Blackbird
- B2. Blue Jay
- B3. Northern Cardinal
- B4. Chickadee
- B5. Common Crow
- B6. Mourning Dove
- B7. American Goldfinch
- B8. Common Grackle
- B9. American Robin
- B10. Swallow
- B11. Woodpecker

Fungi

- F1. Bracket Fungus
- F2. Cup Fungus
- F3. Morel
- F4. Mushroom

Insects & Arachnids

- I1. Bumble Bee
- I2. Carrion Beetle
- I3. False Stag Beetle
- I4. Tiger Beetle
- I7. Monarch Butterfly
- I8. Mourning Cloak Butterfly
- I10. Sulphur Butterfly
- I11. Swallowtail Butterfly
- I13. Daddy-long-legs
- I16. Sheetweb Spider

Mammals

- M1. Chipmunk
- M2. Coyote
- M3. Fox
- M4. Mole
- M5. Opossum
- M6. Rabbit
- M7. Raccoon
- M8. Squirrel
- M9. White-tailed Deer
- M10. Woodchuck

Plants

- P2. Cinquefoil
- P6. Mayapple
- P9. Spring Beauty
- P11. Trillium
- P12. Virginia Bluebells

Snails & Slugs

- S1. Slug
- S2. Cone-shaped Snail
- S3. Disc-shaped Snail

Trees

- T1. Ash
- T2. Cottonwood
- T3. Crab Apple
- T4. Elm
- T5. Hackberry
- T6. Hawthorn
- T7. Maple
- T8. Oak
- T9. Redbud
- T10. Sycamore
- T11. Walnut

Note: Not all taxa are examined during all seasons. Each taxon will retain the same number throughout the seasons, so some numbers will be missing from the seasonal lists.

SUMMER BUS TAXA

Amphibians & Reptiles

- A1. Frog
- A2. Snake
- A3. Toad
- A4. Turtle

Birds

- B1. Red-winged Blackbird
- B2. Blue Jay
- B3. Northern Cardinal
- B4. Chickadee
- B5. Common Crow
- B6. Mourning Dove
- B7. American Goldfinch
- B8. Common Grackle
- B9. American Robin
- B10. Swallow
- B11. Woodpecker

Fungi

- F1. Bracket Fungus
- F2. Cup Fungus
- F4. Mushroom

Insects & Arachnids

- I1. Bumble Bee
- I2. Carrion Beetle
- I3. False Stag Beetle
- I4. Tiger Beetle
- I5. American Copper Butterfly
- I7. Monarch Butterfly
- I8. Mourning Cloak Butterfly
- I9. Painted Lady Butterfly/
American Painted Butterfly
- I10. Sulphur Butterfly
- I11. Swallowtail Butterfly
- I13. Daddy-long-legs
- I14. Grasshopper
- I16. Sheetweb Spider
- I17. Spittlebug

Mammals

- M1. Chipmunk
- M2. Coyote
- M3. Fox
- M4. Mole
- M5. Opossum
- M6. Rabbit
- M7. Raccoon
- M8. Squirrel
- M9. White-tailed Deer
- M10. Woodchuck

Plants

- P1. Aster
- P2. Cinquefoil
- P4. Fleabane
- P5. Goldenrod
- P7. Milkweed
- P8. Monarda
- P10. Sunflower

Snails & Slugs

- S1. Slug
- S2. Cone-shaped Snail
- S3. Disc-shaped Snail

Trees

- T1. Ash
- T2. Cottonwood
- T3. Crab Apple
- T4. Elm
- T5. Hackberry
- T6. Hawthorn
- T7. Maple
- T8. Oak
- T9. Redbud
- T10. Sycamore
- T11. Walnut

Note: Not all taxa are examined during all seasons. Each taxon will retain the same number throughout the seasons, so some numbers will be missing from the seasonal lists.

FALL BUS TAXA

Amphibians & Reptiles

- A1. Frog
- A2. Snake
- A3. Toad
- A4. Turtle

Birds

- B1. Red-winged Blackbird
- B2. Blue Jay
- B3. Northern Cardinal
- B4. Chickadee
- B5. Common Crow
- B6. Mourning Dove
- B7. American Goldfinch
- B8. Common Grackle
- B9. American Robin
- B10. Swallow
- B11. Woodpecker

Fungi

- F1. Bracket Fungus
- F2. Cup Fungus
- F4. Mushroom
- F5. Puff Ball

Insects & Arachnids

- I1. Bumble Bee
- I2. Carrion Beetle
- I4. Tiger Beetle
- I5. American Copper Butterfly
- I6. Angle Wing Butterfly
(Question Mark and Comma)
- I7. Monarch Butterfly
- I8. Mourning Cloak Butterfly
- I9. Painted Lady Butterfly/
American Painted Butterfly
- I10. Sulphur Butterfly
- I11. Swallowtail Butterfly
- I12. Dog Day Cicada
- I14. Grasshopper
- I15. Garden Spider
- I16. Sheetweb Spider
- I17. Spittlebug

Mammals

- M1. Chipmunk
- M2. Coyote
- M3. Fox
- M4. Mole
- M5. Opossum
- M6. Rabbit
- M7. Raccoon
- M8. Squirrel
- M9. White-tailed Deer
- M10. Woodchuck

Plants

- P1. Aster
- P2. Cinquefoil
- P4. Fleabane
- P5. Goldenrod
- P7. Milkweed
- P10. Sunflower

Snails & Slugs

- S1. Slug
- S2. Cone-shaped Snail
- S3. Disc-shaped Snail

Trees

- T1. Ash
- T2. Cottonwood
- T3. Crab Apple
- T4. Elm
- T5. Hackberry
- T6. Hawthorn
- T7. Maple
- T8. Oak
- T9. Redbud
- T10. Sycamore
- T11. Walnut

Note: Not all taxa are examined during all seasons. Each taxon will retain the same number throughout the seasons, so some numbers will be missing from the seasonal lists

WINTER BUS TAXA

Birds

- B1. Red-winged Blackbird
- B2. Blue Jay
- B3. Northern Cardinal
- B4. Chickadee
- B5. Common Crow
- B6. Mourning Dove
- B7. American Goldfinch
- B8. Common Grackle
- B9. American Robin
- B11. Woodpecker

Fungi

- F1. Bracket Fungus
- F4. Mushroom

Insects & Arachnids

- I3. False Stag Beetle
- I6. Angle Wing Butterfly
(Question Mark and Comma)
- I8. Mourning Cloak Butterfly

Mammals

- M1. Chipmunk
- M2. Coyote
- M3. Fox
- M5. Opossum
- M6. Rabbit
- M7. Raccoon
- M8. Squirrel
- M9. White-tailed Deer

Plants

- P1. Aster
- P3. Coneflower
- P4. Fleabane
- P5. Goldenrod
- P7. Milkweed
- P8. Monarda
- P10. Sunflower

Snails & Slugs

- S1. Slug
- S2. Cone-shaped Snail
- S3. Disc-shaped Snail

Trees

- T1. Ash
- T2. Cottonwood
- T3. Crab Apple
- T4. Elm
- T5. Hackberry
- T6. Hawthorn
- T7. Maple
- T8. Oak
- T9. Redbud
- T10. Sycamore
- T11. Walnut

Note: Not all taxa are examined during all seasons. Each taxon will retain the same number throughout the seasons, so some numbers will be missing from the seasonal lists.