Hamilton County Envirothon
Study Guide

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Introduction

Since 1992, the Hamilton County Soil and Water Conservation District has been hosting the Hamilton County Envirothon, an outdoor competition that gives high school students in graded 9 through 12 the opportunity to utilize problem solving techniques, teamwork skills, and knowledge gained during study sessions to complete tests in 5 categories: Aquatics, Forestry, Soils, Wildlife, and Current Issue.

Students hike the nature trail and complete exams written and administered by conservation professionals in each of the 5 test categories. Exams are scored the day of the event, and certificates are distributed during the awards ceremony after lunch. The first place team from the Hamilton County Envirothon has the opportunity to compete at the New York State Envirothon. The winner of the state competition will compete at the national event.

Students attending public and home schools are welcome to participate. Envirothon advisers organize student teams, hold study sessions, and are responsible for obtaining transportation to the Hamilton County and New York State events.

Hamilton County Envirothon Rules and Regulations

1. The Hamilton County Envirothon is Thursday May 5, 2022, 9:15 a.m. - 1:15 p.m. at the Hamilton County Soil and Water Conservation District, 103 County View Drive, Lake Pleasant.

2. Students should dress appropriately as the event will be held rain or shine on the Adirondack EcoTrail behind the District office.

3. Students in grades 9 through 12 may participate, or ages 14 - 18.

4. A team will consist of a minimum of 4 and a maximum of 5 members. Team members may not be drawn from different school districts. More than 1 team from each school or home school may participate. An alternate may be utilized if a regular team member cannot participate. Alternates may attend the Hamilton County competition for the experience but will not participate.

5. Registration forms must be submitted by Monday April 4, 2022. Complete one form per team. Forms are available online at https://forms.gle/H8aFL7rCJwahFp8C9

6. At least one adviser or chaperone per two teams must attend the event. These people must accompany their team(s) during the competition but will not assist their team(s) during the exams.

7. The 5 exam categories are Soils, Forestry, Wildlife, Aquatics, and this year's Current Issue: Waste to Resources.

8. Students have 20 minutes to complete each exam, followed by 5 minutes of answer review with the presenter. They then have 5 minutes to hike to the next testing station.

9. Presenter decisions are final on all events.

10. Transportation to and from the event is the responsibility of the school or home school.

11. Please bring a bag lunch.

12. There will be a winning team in each of the 5 exam categories, as well as overall first, second, and third place. The overall winning team is the team with the highest cumulative score for the five exams. Each exam totals 100 points, for a maximum of 500 points.

13. In the event of a tie, teams will answer a tie-breaker question(s).

14. Certificates will be awarded during a ceremony following lunch, and the first place plaque will be awarded.

15. Hamilton County's winning team has the opportunity to compete at the New York State Envirothon May 25 – 26, 2022 at Hobart and William Smith Colleges, Geneva NY. The winner of the state competition will compete at the National Conservation Foundation's Envirothon July 24 - 30, 2022 at Miami University, Oxford, Ohio.

16. District Manager Caitlin Stewart is available to speak with students interested in the event, and can show a short video.

17. Study materials are available:
- District's website
- NYS Envirothon website

18. Rules and regulations are subject to change. Any changes will be explained to all teams and advisers.

19. By participating in the Hamilton County Envirothon, all parties agree to have their photos and / or video taken and published in print and/or electronically unless a written, signed, and dated request is submitted to the District before the day of the event.

Hamilton County

The following section is quoted from: Silverman, M.H., & Krawiecki, V.J. (2006). Soil Survey of Hamilton County, New York. Retrieved from http://www.hcswcd.com/images/files/SoilSurvey.pdf

"HAMILTON COUNTY is in the central Adirondack Mountains and is one of two counties that lie completely within the Adirondack Park (fig. 1). The New York State holdings comprise most of the county. They are classified as Forest Preserve, which the New York State Constitution has mandated to be left unaltered by man. In its 1,806 square miles Hamilton County has nine towns, one incorporated village, and no cities. Although it is the third largest county in New York, it is the least populated.

General Nature of the County

Laura Flanagan, district manager, Hamilton County Soil and Water Conservation District, helped to prepare this section. This section describes settlement and development, industry and tourism, physiography and geology, drainage, water supply, climate, and ecological units.

Settlement and Development

Hamilton County remained wilderness long after New York State had been divided into counties. At first, the county was included in what was called Albany County, later called Tryon County, part of which is now Montgomery County. Hamilton County was formed in 1816 as a provisional county. It was named in honor of Alexander Hamilton, a member of the Philadelphia Convention and the only member from New York State who signed the U.S. Constitution. In 1840 Hamilton County became permanent. The county seat was Sageville, which was renamed Lake Pleasant. Hamilton County is mostly forestland and over 5 percent water, which comprises more than 500 lakes and ponds (USDA, 1981 and 1987). The county takes in 1,157,400 acres of scenic forests, mountains, and lakes. It contains hundreds of remote, beautiful wilderness lakes and a network of streams flowing into the Black, Mohawk, Hudson, and St. Lawrence Rivers. The county is rugged, and many lakes are accessible only on foot or by airplane. The clear lakes, rivers, and streams and unspoiled forests attract tourists, vacationers, and seasonal residents to Hamilton County and the rest of the Adirondacks. Tourism generally is confined to areas adjacent to highways, hamlets, and the lakes accessible by road. The outdoor enthusiasts these attractions bring in summer and winter create a seasonal population many times that of permanent residents.

Figure 1.—Location of Hamilton County in New York.

Industry and Tourism

The county, roughly rectangular in shape, is 95 miles long north to south and 45 miles wide east to west. It is located about 50 miles north of the populated areas of the Mohawk Valley and about 100 miles northwest of Albany and the surrounding Capital District of New York. The New York State Thruway is about 50 miles to the south, and the Adirondack Northway is about 30 miles to the east. These highways access the major cities of New York and New Jersey to the south and Montreal to the north.

Given the natural resources of the county, the main enterprises are tourism and forestry. Nearly all Hamilton County is forestland, and its economy is oriented toward outdoor recreation and the commercial production of trees. The forests on private land are periodically harvested for both timber and pulp. State-owned timberland is not harvested.

Physiography and Geology

Mark Silverman, soil scientist, and David Sullivan, geologist, both of the Natural Resources Conservation Service, helped to prepare this section.

Hamilton County, located in the northern part of New York State, is entirely within the Adirondack province, a nearly circular dome-shaped extension of the Grenville province of the Canadian Shield. The present Adirondack Mountains are a transitory phase in a 1.1-billion-year geologic history. Many cycles of dynamic geological processes have obscured or destroyed much of the historical record. They include submergence beneath the sea, sedimentation and crustal sagging, volcanism, mountain building and metamorphism, later submergence, and other occurrences. What remains is only the deep root zone of an ancestral mountain system, which in most places is hidden by a thick layer that consists of younger sedimentary rocks and deep glacial till or alluvial soils (Broughton and others, 1961 and 1976).

Mature mountain ranges composed of bedrock that is highly resistant to erosion define the current topography of the Adirondack province. The dominantly crystalline bedrock in Hamilton County is of Precambrian age, or about 600 million years old or older. It consists of several different types of metamorphic rocks. Those of igneous origin are metagabro, metanorthosite, and anorthositic gneiss. Those of sedimentary origin are biotite-quartz-feldspar gneiss, calcitic and dolomitic marble, quartzite, and schist. The bedrock includes numerous metamorphic rocks of uncertain origin (Broughton and others, 1961 and 1976).

During the Pleistocene Epoch, which began about 1.6 million years ago, several advances and retreats of glacial ice covered Hamilton County. An ice sheet that originated in the Laurentian Mountain Region of what is now the Canadian Province of Quebec trended south-southwest into New York State. The ice sheet covered the entire State except a small part of Allegheny State Park on the New York-Pennsylvania border (Broughton and others, 1961 and 1976). The ice advanced and stripped away tons of soil and rounded off resistant rock ridges and hills. The glacier transported eroded material ranging from clay-size particles to giant boulders. The ice sheet, which advanced and retreated, deposited excessive glacial debris from its load.
Four major advances and retreats of the ice sheet have been documented in parts of the United States; however, only the last stage, the Wisconsinan, is evident in New York. Wisconsinan Ice,

which obliterated deposition from previous advances and retreats, reached its maximum advance just south of Long Island. The ice sheet began its final retreat about 10,000 years ago with the closing of the Pleistocene Epoch. Several modes of deposition occurred in Hamilton County as a result of the wasting of the Wisconsinan ice sheet.

Glacial till, the most extensive type of deposit throughout Hamilton County, was deposited under melting glacial ice. Generally quite dense and consisting of unsorted, nonstratified mixtures of clay- to boulder-size material, glacial till is on all hills and mountains and along major valleys and upland plains. It ranges in thickness from mere inches to tens of feet. On mountaintops, ridgetops, and upper slopes, rock outcrops are intermixed with areas of shallow till soils. Examples of soils formed in glacial till deposits are very deep Becket, Potsdam, and Monadnock soils and moderately deep or shallow Rawsonville, Tunbridge, Lyman, and Ricker soils.

As the ice continued to retreat, substantial amounts of meltwater ran over, under, and through cracks in the glacier. Meltwater carried and deposited vast amounts of sand and gravel in transient lakes. Typically, the deposits were sorted and stratified. Adams, Colton, and Naumburg soils, for example, developed in this material.

Minor soils in the county developed as the landscape evolved into its current form. For example, many depressions became shallow lakes supporting growth of aquatic plants. Eventually, partially decomposed plant remains filled some of these areas. Organic soils (peat and muck), such as Wonsqueak and Bucksport soils, formed in these deposits. Rumney soils, which formed on flood plains of small rivers and streams, are commonly intermingled with organic soils.

The location of these different soil types are on the general soils map.

GIS on the geology of Hamilton County is available from the New York State Museum system (http://www.nysm.nysed.gov/gis/

Drainage

The county has four main drainage basins. The upper Hudson Basin drains about 50 percent of the land area to the east and south. The Hudson River borders the county in the Town of Indian Lake; northeast of town the Indian River and Cedar River flow into the Hudson. The Sacandaga River flows south along Route 30 and out of the county in the Town of Benson.

To the north, the St. Lawrence Basin drains roughly 25 percent of the land area of the county. The Raquette River leaves the county to the north near Tupper Lake.

The Black River Basin comprises the west-central part of the county. The South Branch of the Moose River flows into Herkimer County near a midpoint of the west county line. West Canada Creek flows southwest into Herkimer County near the Town of Morehouse and State Route 8, draining into the Mohawk Basin. The Black River and Mohawk River Basins drain roughly 25 percent of the land area to the west and southwest of the county.

Water Supply

Five towns have municipal water supplies. The Towns of Wells and Indian Lake and the Village of Speculator all have drilled wells. The Towns of Long Lake and Raquette Lake have open reservoirs. Rural areas outside population centers with municipal supplies and the rest of the county's population rely on individual drilled wells, shallow dug wells, and springs.

Climate

In Hamilton County the Adirondack Mountains are a major influence on climate. The growing season is short because of high elevations. Frost has occurred in every month of the year, and many gardens planted on a hot day in June have been nipped, if not ruined, in July. Within a calendar year, temperatures may range nearly 130 degrees; winter is the longest season.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Indian Lake in the period 1961-90. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

Table 1.--Temperature and Precipitation

(Recorded in the period 1961-90 at Indian Lake, New York)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily minimum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snow-fall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January--	25.2	1.7	13.4	49	-29	0	2.57	1.27	3.70	6	15.8
February-	27.7	2.8	15.5	51	-28	1	2.27	1.13	3.26	5	13.4
March----	37.4	13.8	25.6	65	-16	10	2.77	1.55	3.84	6	9.7
April----	49.4	26.2	37.8	78	4	76	2.79	1.79	3.69	6	4.0
May------	63.0	37.5	50.2	85	21	330	3.41	2.01	4.66	7	0.1
June-----	71.3	46.0	58.7	87	28	559	3.39	2.01	4.62	8	0.0
July-----	76.0	51.1	63.6	89	35	730	3.40	2.18	4.50	7	0.0
August---	73.6	49.6	61.6	86	33	669	4.22	3.12	5.25	8	0.0
September	66.1	42.7	54.4	83	25	432	3.92	2.26	5.39	7	0.0
October--	55.2	32.5	43.8	77	15	176	3.38	1.77	4.80	7	0.6
November-	41.8	24.1	32.9	65	3	35	3.64	2.64	4.80	8	4.0
December-	29.2	10.0	19.6	54	-22	2	2.91	1.87	3.86	7	23.0
Yearly:											
Average	51.3	28.2	39.7	---	---	---	---	---	---	---	---
Extreme	94	-36	---	90	-31	---	---	---	---	---	---
Total--	---	---	---	---	---	3,021	38.67	32.61	42.42	82	70.6

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1961-90 at Indian Lake, New York)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 26	June 4	June 27
2 years in 10 later than--	May 20	May 30	June 21
5 years in 10 later than--	May 9	May 19	June 9
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 29	Sept. 15	Aug. 28
2 years in 10 earlier than--	Oct. 4	Sept. 21	Sept. 2
5 years in 10 earlier than--	Oct. 14	Oct. 1	Sept. 14

Table 3.--Growing Season

(Recorded in the period 1961-90 at Indian Lake, New York)

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	130	109	66
8 years in 10	139	117	76
5 years in 10	156	134	96
2 years in 10	174	150	116
1 year in 10	183	159	126

In winter, the average temperature is 18.5 degrees F and the average daily minimum temperature is 7.1 degrees. In summer, the average temperature is 59.6 degrees F and the average daily maximum temperature is 71.6 degrees F.

The total annual precipitation is about 39 inches. Of this, 21 inches, or 54 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 14 inches.

The average seasonal snowfall is about 71 inches.

Ecological Units

Constance Carpenter, forester, U.S. Forest Service, Durham, New Hampshire, helped to prepare this section.

The Earth's ecology characterizes the Earth. The ecology of an area is the various ecosystems, or unique interacting systems that connect and influence the properties of the soil, water, air, animals, plants, and of course, people. Ecosystems can be very large and encompass broad areas, such as temperate forests of the midlatitudes, or small and comprise, for example, a local seepage area that supports a rare wetland species. Various broad ecological regions and subregions have been identified throughout the country to help scientists define and diagnose ecosystems. Maps of these areas can help landowners and managers see how their land fits into the bigger environmental picture. The Ecological Units map in this publication shows the relationship of Hamilton County to a system of ecological zones that the U.S. Forest Service has developed (Keys and others, 1995). Each ecological unit both is an important part of a larger ecological system and comprises diverse, smaller ecosystems (table 4a).

Table 4a.—Subsections of the Adirondack Mountain Section (M212D) in Hamilton County

M212Da	Adirondack Hills and Flats
M212Db*	Western Adirondack Foothills
M212Dc*	Adirondack Highlands and Lakes
M212Dd*	Central Adirondack Mountains*
M212De*	Eastern Adirondack Low Mountains*
M212Df*	Adirondack Peaks*

*Comprises a part of Hamilton County.

Hamilton County lies within the ecological unit called the Adirondack Mountain Section (M212D). The Adirondack Mountain Section is part of the Adirondack-New England Mixed Forest-Coniferous Forest-Alpine Meadow Mountainous Province, which extends from New York eastward to Maine. The Adirondack Mountain Section (M212D) contains six subsections, four of which comprise parts of Hamilton County.

The Adirondack Mountain Section is a dissected, asymmetrical dome in overall configuration. It is most mountainous, highest, and steepest in the north and east, and has lower, rolling hills further south and west. The bedrock, an extension of the Grenville province of the Canadian Shield, is mainly Proterozoic metamorphic and plutonic rocks, which consist mainly of gneiss and highly metamorphosed granite, anorthosite, syenite, and gabbro. Most of the highest mountains consist of resistant metanorthosite. Mixed gneisses underlie rolling hills. Cambrian sandstone underlies the northern margin of the dome. This sandstone and some Ordovician sediments overlie the Canadian Shield bedrock in small grabens across the dome. Continental and mountain glaciation are responsible for many surficial geologic features. These include cirques and other scour features, moraines, lake plains, and a prominent esker system in the north-central area. Elevation ranges from 500 to 5,344 feet (150 to 1,630 meters); local relief ranges from 1,000 to 3,000 feet (300 to 900 meters). Gentle slopes cover 20 to 50 percent of the area; more than 75 percent of gently sloping lands are on lowlands rather than uplands. Table 4b shows an abbreviated description of the geomorphology, elevation, and geologic characteristics of the subsections (Keys and others, 1995; Hammond, 1994).

Table 4b.--Geomorphology, Elevation, Quaternary Geology, and Stratigraphy and Lithology of Subsections of the Adirondack Mountain Section

Geomorphology*	Elevation	Quaternary geology	Stratigraphy and lithology
	Ft		
Plains with hills, glaciated peneplane	900-2,518	Wisconsinan coarse loamy till, sandy till, outwash outwash, and lake deposits	Proterozoic gneisses and shists
Plains with hills, glaciated peneplain	800-2,518	Wisconsinan variable textured and sandy till	Precambrian gneisses and schist, calc-silicates, and marble
Open hills and high hills, glaciated peneplain	1,500-2,500	Wisconsinan variable textured and sandy till, outwash and delta deposits, rock outcrops, and alluvium	Precambrian gneiss and anothrosite
Open low mountains, glaciated, block faulted	1,600-3,900	Wisconsinan sandy textured and variable textured till, till, in-wash and alluvial in-wash, and rock outcrops	Precambrian gneisses and shist
Open low mountains, glaciated, block vaulted	400-2,600	Wisconsinan variable textured till and rock outcrops	Precambrian gneisses and schists
Open low and high mountains, continental and mountain glaciation	1,000-5,344	Wisconsinan variable textured till and rock outcrops; glaciofluvial deposits in valleys	Precambrian gneisses and anothrosite

*The descriptions of geomorphology conform to Classes of Land Surface Form in the Forth-eight States (Hammond, 1994).

Broad scale climatic conditions influence the composition and productivity of ecosystems from region to region. Cold dry air of polar origin and warm, moist air of tropical origin are the most common influences of the Adirondack Mountain Section. Pronounced seasons and strong annual cycles of temperature and precipitation are the rule. The number of storms that pass through the Section is large compared to other areas of the country. Frequent storm passages with accompanying changes in air mass result in abrupt and often drastic changes in daily weather conditions. Although precipitation is distributed fairly uniformly throughout the year, the amount of variation from year to year can be quite pronounced. Differences in elevation and aspect with regard to the prevailing wind influence the spatial distribution of precipitation. Precipitation is greater at higher elevations. Pronounced differences in temperature and in length of the growing season reflect differences in elevation. Cooler temperatures and shorter growing seasons are associated with higher altitudes (De Gaetano, 1996). Climatic data derived from weather stations throughout the area are presented in Tables 4c-4e.

Table 4c.--Precipitation-Related Variables of Subsections in the Adirondack Mountain Section

	Annual precipitation			Distribution			
	Mean			Mean wettest		Mean driest	
Subsection	Average	Highest	Lowest	Amount	Month	Amount	Month
M212Da	38.67	42.55	34.79	4.72	Aug.	2.05	Feb.
M212Db	43.92	49.77	35.65	4.68	Aug.	2.57	Feb.
M212Dc	44.64	48.87	40.38	4.77	Aug.	2.55	Feb.
M212Dd	39.04	39.04	39.04	4.22	Aug.	2.27	Feb.
M212De	38.55	42.55	35.32	4.52	Aug.	2.18	Feb.
M212Df	37.97	37.97	37.97	4.46	Aug.	1.99	Feb.
M212D (all)	41.45	49.77	34.39	4.63	Aug.	2.35	Feb.

	Moisture ratio (ET/Precip)		Annual snow cover			
Subsection	Maximum monthly average	Month of occurrence	Average	Maximum highest	Lowest	Number of stations
MD212Da	1.31	July	24	30	17	2
MD212Db	1.34	July	21	21	20	3
MD212Dc	1.16	July	29	36	20	4
MD212Dd	1.40	July	10	10	10	1
MD212De	1.43	July	13	30	2	3
MD212Df	1.22	July	9	9	9	1
MD212D (all)	1.30	July	20	36	2	14

Table 4d.--Temperature-Related Variables of Subsections in the Adirondack Mountain Section

(Average temperature is the mean of all stations in a subsection. Extreme temperature is the coldest, or warmest, temperature recorded at a station in a subsection.)

	Annual temperature			January temperature					
	Mean			Mean					
Subsection	Average	High	Low	Average	High	Low	Mean High	Minimum Low	Extreme Minimum
M212Da	42.3	42.9	41.7	14.7	15.0	14.5	4.9	4.8	-36
M212Db	41.9	42.9	40.3	14.8	15.7	13.3	5.1	2.2	-44
M212Dc	40.0	40.4	38.9	13.0	13.9	11.5	3.3	0.0	-52
M212Dd	39.8	39.8	39.8	13.8	13.8	13.8	2.3	2.3	-36
M212De	43.2	45.7	41.7	15.9	17.6	15.0	7.7	4.8	-38
M212Df	39.6	39.6	39.6	13.6	13.6	13.6	2.8	2.8	-37
MD212D (all)	41.4	45.7	38.9	14.4	17.6	11.5	7.7	0.0	-52

	July temperature						
	Mean			Mean Maximum			
Subsection	Average	High	Low	High	Low	Extreme maximum	Number of stations
M212Da	67.6	68.8	66.4	79.6	78.2	100	2
M212Db	66.5	67.6	64.9	81.1	75.8	100	3
M212Dc	64.5	65.2	63.3	77.2	75.6	98	4
M212Dd	63.3	63.3	63.3	76.1	76.1	94	1
M212De	68.6	71.7	66.4	84.1	78.1	100	3
M212Df	63.6	63.6	63.6	75.7	75.7	92	1
MD212D (all)	66.1	71.7	63.3	84.1	75.6	100	14

Table 4e.--Growing Season Variables of Subsections in the Adirondack Mountain Section

(Length of frost-free days (average growing season) and day of year frost occurs are means of all stations in a subsection. Extreme day of year frost occurs is the latest, or earliest, frost recorded at a station in a subsection.)

	Frost-free days		Latest spring frost				Earliest fall frost				
	Mean		Mean		Extreme		Mean		Extreme		Number of stations
Subsection	32 °F	28 °F	32 °F	28 °F	32 °F	28 °F	32 °F	28 °F	32 °F	28 °F	
M212Da	125	154	144	128	163	154	269	282	237	263	2
M212Db	123	149	144	130	167	160	267	279	228	243	3
M212Dc	108	140	152	136	208	177	260	275	229	241	4
M212Dd	98	136	159	139	213	167	257	275	214	250	1
M212De	140	166	134	121	163	154	274	287	237	263	3
M212Df	98	128	157	143	181	162	255	271	229	244	1
M212D (all)	119	148	146	131	213	177	265	279	214	241	14

More than 90 percent of the Adirondack Mountain Section is forested. Regionally important broad vegetation types include montane spruce-fir forest, lowland spruce-fir forest, northern hardwood-conifer forest, alpine krummholz, and alpine meadow communities. Table 4f shows Natural Community Alliances known to occur within this section (Anderson, 1996; Sneddon and others, 1994). Alliances are physiognomically uniform groups of plant associations allied by identifying important shared species among plant associations. The distribution of alliances within the section varies, and listings in table 4f should not be used to infer every community is found in every place throughout the Section.

Table 4f.--Natural Community Alliances within the Adirondack Mountain Section

(The natural community alliances listed below are those of The Nature Conservancy (Anderson, 1996; Sneddon and others, 1994). The crosswalk codes identify fuller descriptions of the natural community alliances available from The Nature Conservancy, Adirondack Chapter, Keene Valley, New York.)

Natural community		
Formation	Alliance description	Crosswalk code
Forest	Hemlock-hardwood ravine	1C3a6
	Hemlock-white pine forest	1A8b1
	Red maple-conifer swamp	1C3b2
	Sugar maple-ash-basswood-rich northern hardwood forest	1B2a2
	Oak-hickory-ash dry forest	1B2a6
	Silver maple flood plain forest	1B2B3
	Maple-beech-birch northern hardwood forest	1B2a1
	Red maple-black ash seepage swamp	1B2f2
	Northern oak-white pine forest	1C4a5
	Spruce fir forest	1A8c2
	Spruce fir swamp	1A8f2
	Black spruce bog forest	1A8f3
	Red maple-cedar swamp	1C3B3
	White pine-red pine forest	1A8b2
	Northern white cedar swamp	1A8f4
	Yellow birch-spruce transition forest	1C3a7
	Black spruce forest	1A8c3
Woodlands	Red maple swamp woodland	2B4e1
	Pine-heath woodland	2A2a3
	Red oak summit woodland	2B4a3
	Black spruce bog woodland	2A2e3
	Spruce fir acidic rock summit	2A2b1
	Northern white cedar woodland	2A2b2
Shrublands	Alder thickets	4B3d1
	Black willow shrub thickets	4B3d3
	Buttonbush shrub swamp	4B3g1
	Highbush blueberry shrub swamp	4B3g3
	Leatherleaf-slender sedge acid fen	5B2c2
	Sweet gale-slender sedge fen	5B2c3b
	Spruce fir krumholtz	4A21
Dwarf shrublands	Blueberry heath	6B2d1
	Leatherleaf bog	6A1d1
	Alpine blueberry heath	6B2e3
	Black crowberry wet heath	6A3d1
Herbaceous areas	Cattail marsh	8A2d1
	Bulrush marsh	8A2d2
	Tussock sedge meadow	8B2e2
	Pickerel weed-arrowarum emergent vegetation	8B1b1
	Floating spatterdock vegetation	8F2a1
	Submerged pondweed vegetation	8F2a2
	Big bluestem-indian grass prairie	8A2a1
	Bluejoint-reed canary grass meadow	8A2c1
	Riverside seep	8B2a3
	Alpine meadow	8C2d1
	Scirpus cespitosus meadow	8C2d2

Natural events and management activities cause the age and complexity of a forest to change over time (Cleland and others, 1997). The most common natural disturbance in montane spruce fir and spruce-northern hardwood forests is blowdown during windstorms. Windthrow areas here are generally small, but some large storms or hurricanes cause extensive damage. At high elevations persistent winds and high temperatures stress and kill trees. A mountain phenomenon called a “fir-wave” occurs as a domino effect where the loss of one tree leads to exposure and

death of a succession of trees. Forest fires are uncommon in the Adirondack Section. Insects and diseases active in this area include gypsy moth, spruce budworm, periodic severe spruce beetle, beech bark disease, and sugar maple defoliators. Scleroderis canker on red pine is an ongoing disturbance. At higher elevations spruce decline is related to severe winter injury and depletion of cations in the soil. Hardwood-dominated communities are more extensive now than in presettlement times because of intensive, selective logging of conifers and the impact of fires following cutting and resultant accumulated slash (McNab, 1994).

Perennial streams, lakes, and reservoirs provide abundant water. Drainage patterns were imposed on basement rock of the Adirondacks during geologic uplift and erosion. Overall stream drainage pattern is radial, but southwest to northeast trending faults influence patterns in the central part. Stream gradients are low in the interior of the Section and moderate to steep on the perimeter, where there are waterfalls and rapids. Average annual runoff ranges from 20-35 inches (510-890mm), increasing with elevation. Maximum monthly streamflow occurs in March and April. Extreme peak flows can occur any time of the year and are usually associated with hurricanes or rain-on-snow events. Minimum monthly flows occur in August, September, and October. Many small lakes and wetlands formed in proglacial deposits. Lake George, the largest lake in the Adirondack Section, is a graben lake."

Aquatics

Introduction

Aquatics or aquatic ecology is the study of the relations of organisms to one another and to their freshwater environments including lakes, ponds, wetlands, rivers, and streams. By preparing for the Aquatics exam, students will learn about Hamilton County's common aquatic species, watersheds, wetlands, and the hydrologic cycle. Essential to understanding and appreciating the field of aquatics is a basic knowledge of the physical and chemical properties of water.

Water is arguably the most valuable substance on the planet, and is the common name applied to the liquid state of the hydrogen oxygen compound H2O. It covers 70% of the surface of the Earth forming swamps, lakes, rivers, and oceans. Pure water has a blue tint, which may be detected only in layers of considerable depth. It has no taste or odor. Water molecules are strongly attracted to one another through their two hydrogen atoms. At the surface, this attraction produces a tight film over the water (surface tension). A number of organisms live both on the upper and lower sides of this film.

Density of water is greatest at 39.2° Fahrenheit (4° Celsius). It becomes less as water warms and, more important, as it cools to freezing at 32° Fahrenheit (0° Celsius), and becomes ice. Ice is a poor heat conductor. Therefore, ice sheets on ponds, lakes and rivers trap heat in the water below. For this reason, only very shallow water bodies never freeze solid.

Water is the only substance that occurs at ordinary temperatures in all three states of matter: solid, liquid, and gas. In its solid state, water is ice, and can be found as glaciers, snow, hail, and

frost and ice crystals in clouds. It occurs in the liquid state as water droplets in rain clouds, and on vegetation as dew. Under the influence of gravity, water may accumulate in the openings of hard rock beneath the surface of the earth. This groundwater sustains wells, springs and some streams. As a gas, or water vapor, it occurs as fog, steam, clouds, and humidity.

The transparency of water permits enough light to penetrate for plants to carry on photosynthesis and animals to thrive. The depths to which light can penetrate decrease as water contains more suspended materials and becomes turbid (or less clear). Less light means fewer plants can grow, thus attracting less wildlife.

Our dependence upon water and competition for it have imperiled and will continue to threaten aquatic environments and the organisms living in them. Good water quality is essential for aquatic life as well as for the human species. Recently, the historical emphasis on political entities, such as counties, towns, villages and cities, has shifted to watersheds. It has been said that one-third of the world's population will experience a water shortage crisis in 2025. Wars in the future may well be fought for water rather than for oil.

Learning Objectives

- Know and label the processes and phases of the hydrologic cycle and understand the role of water in soil erosion, groundwater recharge, and climatic influences.
- Describe the chemical and physical properties of water and their relation to freshwater ecosystems.
- Identify common, rare, threatened and endangered aquatic species as well as aquatic invasive species.
- Understand the niche of organisms in aquatic food webs.
- Know the pollution tolerance of freshwater macroinvertebrates.
- Understand the concept and components of a watershed.
- Identify stream order, drainage patterns, and watershed boundaries.
- Know the features of a healthy watershed and an unhealthy watershed.
- Know sources of and solutions for watershed pollution.
- Be familiar with both New York State and federal water protection laws, and the agencies that enforce those laws. Understand the requirements for permits.
- Discuss ways to conserve water and reduce point and non-point source pollution.
- Identify aquatic and wetland environments based on their physical, chemical and biological characteristics.
- Understand the benefits, ecological functions, and values of riparian zones, wetlands and open water systems and be able to identify the associated zone areas or types.
- Understand the dependence of all organisms on one another and how energy and matter flow within an aquatic ecosystem.
- Understand the concept of carrying capacity for a given aquatic ecosystem, and be able to discuss how water usage may affect the ability of the system to sustain different needs.
- Know characteristics of different types of aquifers, and understand historical trends and threats to groundwater quantity and quality.
- Recognize types of water pollution such as organic, inorganic, thermal, toxic, etc.

- Understand the concept of lake trophic state, and how lakes change over time from ologotrophic to mesotrophic to eutrophic.
- Identify Hamilton County watersheds.
- Be familiar with the actions of good lake stewards.
- Be familiar with general terminology and definitions pertaining to the subject area.

Skills

- Identify water monitoring equipment and know the uses of the following: secchi disk; chlorophyll *a* tube; invasive plant rake; kick net; handheld salinity, conductivity, and temperature probe; benthic grab sampler; Kemmerer water sampler; Aqua Scope viewing scope; and pH meter.
- Use a dichotomous key to identify benthic macroinvertebrates.
- Identify samples of aquatic invasive species.
- Use a topographic map to identify and delineate a watershed.
- Identify native and invasive fish samples.
- Know how to read a lake temperature profile and identify the hypolimnion, metalimnion, epilimnion, and thermocline.

Outline

I. Abiotic Factors
    A. Water cycle
    B. Watershed features
        1. Stream order
        2. Stream health factors
        3. Identify boundaries
    C. Water conditions
        1. Physical
        2. Chemical
        3. Biological

II. Biotic Factors
    A. Energy flow
    B. Carrying capacity
    C. Identify aquatic species including plants, fish, amphibians, microinvertebrates, and macroinvertebrates.
        1. Common
            a. Basic physiology
            b. Lifecycles
            c. Habitat
        2. Rare, threatened, endangered
        3. Invasive
        4. Water quality indicators

III. Aquatic Environments
    A. Wetlands
        1. Definition
        2. Characteristics
        3. Functions, importance, values
    B. Riparian zones
    C. Aquifers and groundwater
    D. Ponds and lakes
        1. Temperature zones
        2. Vegetation

IV. Water Protection and Conservation
    A. Water quality and pollution
        1. Groundwater
        2. Surface water
    B. Types of pollution
        1. Point source
        2. Nonpoint source
        3. Thermal
        4. Control methods
    C. Management and legislation
        1. Laws
        2. Agencies

Sample Questions

1. All of the following are invasive aquatic plants EXCEPT
    a. Eurasian Watermilfoil
    b. Curlyleaf Pondweed
    c. Pickerelweed
    d. Fanwort

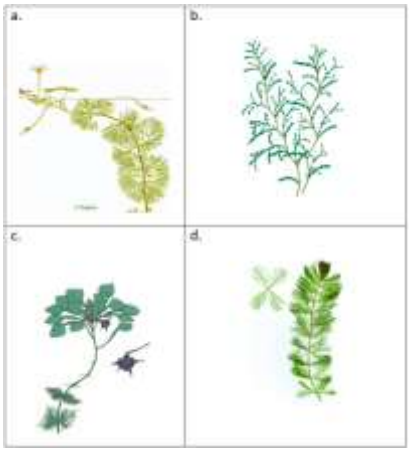
2. A watershed may be enhanced by
    a. Cleaning up pet waste
    b. Building a rain garden in your backyard
    c. Washing your vehicle on the lawn instead of the driveway
    d. All of the above
    e. A and B

3. Macroinvertebrates that are biological indicators of good water quality include
    a. Blackfly larva, midge larva, and leeches
    b. Water penny beetle larva, mayfly nymphs, and hellgrammites
    c. Aquatic worms, pouch snails, and mosquito larvae
    d. Flatworms, rat-tailed maggots, and water scavenger beetles

4. An example of point source pollution is
    a. Acid deposition
    b. Rainfall that picks up and carries fertilizers into a lake
    c. Urban runoff
    d. A paper mill pipe that discharges pollution into a stream

5. Lake water is analyzed for total alkalinity in order to determine
    a. The hydrogen ion (acid) concentration
    b. Algal biomass
    c. The lake's ability to neutralize acid precipitation
    d. Nitrate levels

6. Which photo below shows the aquatic invasive plant Fanwort?



7. A bog

a. is a seasonal depressional wetland that is covered by shallow water in the winter and spring for variable periods, but may be completely dry in the summer and fall

b. is a wetland dominated by woody plants

c. is a partially enclosed body of water where freshwater meets ocean water

d. receives the majority of its water from precipitation and is characterized by peat deposits, acidic waters, and sphagnum moss

8. How does thermal pollution kill aquatic organisms?

a. Heat increases the solubility of oxygen in water, and organisms die from oxygen shortages

b. Heat decreases the solubility of oxygen in water, and organisms die from oxygen shortages

c. Heat decreases the pH of water, and organisms die from acidic waters

d. Heat increases the rate of predator reproduction, and all prey are eaten

9. A lake ecosystem is termed "phosphorous limited" if

a. adding nitrogen to the lake causes increased phytoplankton growth

b. adding phosphorus to the lake causes increased phytoplankton growth

c. adding nitrogen to the lake causes decreased phytoplankton growth

d. adding phosphorus to the lake causes decreased phytoplankton growth

e. adding phosphorus to the lake causes no change in phytoplankton growth

10. Lake water quality may be protected by

a. Planting a buffer between your lawn and the lake

b. Not dumping aquarium water, plants, or aquatic pets into the lake

c. Maintaining your septic system

d. All of the above

e. A and C

Glossary

Acid rain - rain containing pollutants that give it a pH of less than 7.0.

Algae - photosynthetic organisms with a one-celled or simple multicellular body plan.

Aqueous - containing or composed largely of water.

Aquifer - a land, gravel or rock formation capable of storing or conveying water below the surface of the land.

Bacteria - unicellular microorganisms of the class Schizomycetes existing as free living organisms or parasites.

Benthic macroinvertebrate - small animals living among stones, logs, sediments and aquatic plants on the bottom of streams, rivers and lakes. They are large enough to see with the naked eye (macro) and have no backbone (invertebrate). They are also called benthos.

Benthos - bottom dwelling or substrate-oriented organisms.

Best Management Practices - a practice or combination of practices that provide an effective, practical means of preventing or reducing pollution from non-point sources.

Bioaccumulate - the practice of concentrating a particular substance over time.

Biochemical Oxygen Demand (BOD) **-** a measure of the quantity of oxygen used by microorganisms in the aerobic oxidation of organic matter.

Biodiversity - the variety of life in the world or in a particular habitat or ecosystem.

Biomonitoring - the use of organisms to assess or monitor environmental conditions.

Bog – a wetland characterized by spongy peat deposits, acidic waters and a floor covered by a thick carpet of sphagnum moss. Bogs receive all or most of their water from precipitation rather than from runoff, groundwater or streams. As a result, bogs are low in the nutrients needed for plant growth, a condition that is enhanced by acid forming peat mosses.

Brook - a small stream.
Buffer - a vegetated area of grass, shrubs or trees designed to capture and filter runoff from adjoining land uses.

Channelization - the practice of straightening a water course or stream to remove meanders and make the water flow faster. Sometimes concrete is used to line the sides and bottom.

Cobble stone – 2 **-** 10 inch size stones where stream life can be found.

Coliform bacteria - a group of bacteria found in cold and warm blooded animal intestines commonly used as indicators of pathogens.

Cultural eutrophication - process whereby human activity increases the amount of nutrients entering surface waters.

Culvert - a closed passageway (such as a pipe) under roadways and embankments which drains surface water.

Decomposition - the separating or decaying of organic or chemical matter.

Dendritic - a pattern of stream drainage that resembles the pattern of a tree.

Density of water - is greatest at 4°(39.2°F).

Dilute and disperse - the practice of discharging a substance into a large body of water that will carry the substance away from its source and reduce its concentration.

Discharge - the flow of surface water in a stream or canal or the outflow of groundwater from a flowing artesian well, ditch or spring.

Discharge pipe - a pipe used to carry wastewater from a factory or other facility into a receiving stream or lake.

Dissolved oxygen - oxygen dissolved in water which is readily available to plants and animals.

Drainage basin - a large watershed usually referring to the combination of several watersheds.

Ecology - the science of the relationships between organisms and their environments.

Ecosystem - an ecological community together with its physical environment, usually considered as a unit.

Ephemeral stream - a stream that flows only during wet periods or rainstorms.

Epilimnion - topmost layer of water in a lake.

Estuary - an arm of the sea that extends inland to meet the mouth of a river, usually characterized by tidal changes and rich diversity of aquatic life.

Eutrophic lake – a productive lake that supports a very large biomass. Eutrophic lakes are normally weedy with frequent algae blooms. There is often a large amount of accumulated organic matter on the bottom of the lake. These lakes are susceptible to oxygen depletion in the hypolimnion.

Eutrophication - a process in which organic matter accumulates in a body of water until eventually it fills in and becomes dry land.

Fecal coliform - that part of the coliform group of bacteria originating in the intestinal tract of warm blooded animals.

Fen – a peat-forming wetland that receives nutrients from sources other than precipitation: usually from upslope sources through drainage from surrounding mineral soils and from groundwater movement. Fens differ from bogs because they are less acidic and have higher nutrient levels. Therefore, they are able to support a much more diverse plant and animal community. These systems are often covered by grasses, sedges, rushes and wildflowers.

Floodplain - a low area of land, surrounding streams or rivers, which holds the overflow of water during a flood.

Freshwater - water that is not saline or brackish.

Groundwater - water beneath the earth's surface between saturated soil and rock.

Habitat - the area or environment in which an organism lives.

Hardness - a characteristic of water caused by the presence of various salts, calcium, magnesium and iron.

Headwaters - the uppermost reaches of a river or stream.

Hydric soils - soils found in saturated, anaerobic environments usually characterized by gray or mottled appearance, found in wetlands.

Hydrologic cycle - the series of pathways the earth's water may take on its journey from the sea to the atmosphere to the land and ultimately back to the sea.

Hydrologic unit - all land and water within a drainage area.

Hypolimnion - lower layer of water in a lake.

Infiltration - the downward entry of water into the soil.

Instar - the individual insect between two molting events or an organism between egg hatching and the first larval molt.

Intermittent stream - a stream which has an interrupted flow or does not flow continuously.

Invasive species - plants, animals, and other organisms either accidentally or intentionally introduced from other places that cause harm to the environment, economy, or human health.

Larvae - the plural of larva, the first major mobile life stage of an insect or first development following egg hatching.

Lentic - standing water as in a lake.

Limiting factor - something that determines the presence, survival and success of an organism.

Limnology - the study of inland water: ponds, lakes and streams.

Littoral - region of shallow water where light reaches the bottom.

Lotic - running water as in a river.

Macroinvertebrate - an animal without a backbone visible to the naked eye or larger than 0.5 millimeters.

Marsh – a wetland frequently or continually inundated with water, characterized by emergent soft-stemmed vegetation adapted to saturated soil conditions. Nutrients are plentiful and the pH is usually neutral leading to an abundance of plant and animal life. Water is received from surface water or groundwater.

Meander - the circuitous winding or sinuosity of a stream, used to refer to a bend in the river.

Mesotrophic Lake – a lake that has more nutrients and production than an oligotrophic lake, but not as much as an eutrophic lake. Mesotrophic lakes have some accumulated organic matter on the bottom of the lake, as well as an occasional algal bloom at the surface. They are usually good lakes for fishing and support a good range of biodiversity.

Monitoring - to watch and care for a stream on a regular basis.

Nitrate - an important nutrient for building protein in plants and animals.

Nonpoint source pollution (NPS) - pollution that originates from many diffuse sources and usually is not regulated, such as runoff from streets that carries with it oil, feces and sediment.

Oligotrophic lake - a body of fresh water that contains few nutrients and few organisms. A lake that is generally clear and deep with low primary production.

Part per million (ppm) - the quantity of one substance contained in one million units of another substance. Equivalent to milligram per liter (mg/l).

Perennial stream - a stream which flows continually.

pH - a symbol used to indicate how acidic or basic a solution is.

Phosphorus - an important nutrient for life, especially plants and algae.

Plankton - collective word for microscopic organisms that drift around in the upper level of a body of water.

Point source pollution - Pollution that is discharged through a pipe or other conduit and is usually a regulated discharge.

Pollutant - any substance or mixture of substances that defile or contaminate the soil, water or atmosphere.

Pond - a quiet body of water so shallow that rooted plants usually grow completely across it.

Profoundal - region of water below photosynthetic light penetration.

Receiving waters - all distinct bodies of water that receive runoff such as streams, rivers, ponds, lakes and estuaries.

Riffle - a hallow section of a stream where water bubbles over rocks, often found at the bend in a river.

Riparian - relating to the banks of a stream or river.

River - a body of running water of considerable volume usually moving over the earth's surface in a channel or bed.

Run - the straight section in a river between riffles, also refers to fish migration.

Runoff - water, including rain and snow, which is not absorbed into the ground: instead it flows across the land and eventually runs into streams and rivers. Runoff can pick up pollutants from the air and land, carrying them into the stream.

Salt water - water that is saline.

Secchi disk - a simple device for measuring turbidity.

Sediment - soil, sand, and materials washed from land into waterways.

Settling ponds - ponds constructed or used to hold storm water and other runoff where heavy materials can settle and the water can become clear before being discharged.

Stream - a body of running water moving over the earth's surface in a channel or bed.

Streambank - the side of a stream.

Stream order - system used to number streams and their tributaries with first order as the headwater stream. When joined by another first order stream the union of two streams becomes a second order stream and so on.

Subwatershed - a small watershed that is part of a larger watershed such as the watershed of a tributary stream.

Surface water - Water that flows over or is found on the earth's surface.

Swamp – a wetland dominated by woody plants. They are characterized by saturated soils during the growing season and standing water during certain times of the year. The highly organic soils of swamps form a thick, black, nutrient-rich environment for the growth of water-tolerant trees.

Thermocline (metalimnion) - intermediate (middle) layer of water in a lake.

Total solids - a term used to describe all the matter suspended or dissolved in water.

Tributary - a stream or river that flows into another larger stream or river.

Turbidity - a measure of water cloudiness caused by suspended solids.

Waterfowl - birds that depend on water for habitat i.e. ducks.

Watershed - an area of land that drains into a particular river or body of water usually divided by topography.

Watertable - the upper level of groundwater.

Waterway - a natural or man-made place for water to run through (such as rive, stream, creek, or channel).

Wetland - an area of land that is saturated at least part of the year by water, usually found in depressions, low-lying areas or along floodplains or coastal areas.

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What do Aquatic Ecologists Do?

Water nourishes life. It is the single most important resource on the earth, and without it humans could not survive. Aquatic Ecologists study the earth's water systems; they monitor, research and analyze the relationship of aquatic organisms to one another and to their watery habitat. Aquatic Ecologists also observe microscopic life, chemical reactions, human impact, geologic activity and native as well as nonnative species within a specific aquatic environment. Through these observations they hope to garner an understanding of how aquatic ecosystems interact as a whole. They use the information gained from monitoring programs to determine future conservation and management strategies for aquatic ecosystems.

To become an Aquatic Ecologist one must first attend a four year bachelor's degree program at an accredited university. Graduates with majors in Environmental Science are the most prevalent in the field of Aquatic Ecology, but Aquatic Ecologists can also come from a varied scientific background including chemistry, geology, geography, biology, climatology, statistics and even economics. In today's economy, postgraduate work in ecology or science is becoming a requirement for work in Aquatic Ecology research.

Aquatic Ecologists work many hours outdoors gathering data and just as many hours in the lab or behind a computer analyzing that field data. They often work with mathematical models analyzing and interpreting human actions and their effects on aquatic ecosystems. An Aquatic Ecologist must have strong verbal and writing skills in order to accomplish intensive research and present their findings in simple, concise and well - written oral reports and journal articles.

An Aquatic Ecologist may work with the government, a non-profit, or even in the corporate sector. They often work for government agencies such as the United States Environmental Protection Agency, United States Fish and Wildlife Service, state environmental agencies, or local Soil and Water Conservation Districts. Aquatic Ecologists can also become teachers, professors or researchers for private companies. A recent graduate can expect to make between $30,000 and $40,000 per year, or more depending on experience and the extent of their education.

Forestry

Introduction

The forestry station will focus on forests as ecosystems in the Adirondacks. Students will be expected to have a basic understanding of forested ecosystems, how they function and change over time, their role in a watershed, and why they are valuable resources.

In general, the word forestry means the propagation and management of forest trees for commercial harvest. This includes the planting and management of exotic (nonnative) species, the existing native forest, and the genetic improvement of trees for selected characteristics such as straight and rapid growth. Forestry also means the scientific study of tree growth, management, and timber production systems. The term forestry probably evokes visions of loggers, tree farms, and large tracts of woodlands. In heavily populated areas, however, forestry often encompasses an urban twist. Urban forestry is a relatively new term, originating in the 1960s in Canada. The concept of urban forestry will be prominently featured as a part of ecosystem management in the future. Urban forestry often applies to the planting and care of street and park trees, but also applies to restoration and management of natural forests in urban and suburban areas.

National forests provide vital ecosystem services, such as habitat for wildlife and native plants, act as water reservoirs and filters, take up carbon dioxide, release oxygen, and regenerate precious soil. In addition to ecosystem services, forests also provide humans with lumber, recreation areas, and aesthetic value. Forests store large amounts of carbon dioxide that might otherwise contribute to global warming, in the form of wood.

In the eastern United States, deciduous hardwood forests characterize the dominant forest types. In the western United States, coniferous evergreen forests dominate. In the United States, we have several major forest biomes including temperate deciduous forests, sub-tropical mixed forest, temperate mixed forest, temperate coniferous forest and taiga. Much of the forest area in the west still remains under public ownership, held as either national forest or Bureau of Management land. In the east, however, much of the surviving forests are under private ownership. Founded in 1905 by Gifford Pinchot, the United States Forest Service (part of the United States Department of Agriculture) is the single most important agency with reference to public forest land.

Students should be aware of and knowledgeable about the following: identification of common tree species as well as tree parts and function; basic characteristics of forests and forest structure; forests as ecosystems; a general knowledge of forest history in our region; issues affecting forest health and management including invasive plants, fragmentation and urban sprawl; plant and animal communities that inhabit local forests; and silvicultural practices.

Learning Objectives

- Understand tree growth, parts and tissues of a tree, and the life cycle of a tree.
- Identify common tree species from bark, leaves or seed without a key, and identify unusual trees and shrubs with the use of a key.

- Know the typical forest structure: canopy, understory and ground layers and crown classes and the common species that are found in each layer.
- Understand forest ecology concepts and factors affecting them, including tree communities, regeneration, competition, and primary and secondary succession.
- Identify the abiotic and biotic factors in a forest ecosystem, and understand how these factors affect tree growth and forest development including the relationship between soil and forest types.
- Consider factors such as climate, insects, microorganisms, and wildlife.
- Be familiar with and able to identify common and invasive tree pests and diseases. Be able to identify associated control methods.
- Understand silvicultural terms, and be able to explain the uses of the following techniques: thinning; single tree and group tree selection; shelter wood; clear cutting; seed tree management; and high grading.
- Explain the following silviculture systems: clear-cutting; seed tree method; even aged management; uneven aged management; shelter wood; and selection.
- Know how to use forestry tools and equipment to measure tree diameter, height and basal area.
- Know how to use and read a Biltmore stick, grade scale, and log chart.
- Understand how forest health and management affect biodiversity, global warming, and forest fragmentation.
- Understand how economic, social and ecological factors influence forest management decisions.
- Understand the importance and value of trees in urban, suburban, rural, and community settings, and know the factors affecting their health and survival.
- Know the criteria used to determine forest health.
- Understand the economic value of forests and know many of the products they provide to people and society.
- Understand why trees and forests are important to human health, recreation, wildlife, and watershed quality.
- Understand how wildlife habitat relates to forest communities; forest species; forest age and structures; snags and den trees; availability of food; and riparian zones.
- Understand how the following issues are affected by forest health and management: biological diversity; forest fragmentation; air quality aesthetics; fire; global warming; and recreation.
- Be familiar with the concepts of forest fragmentation, edge effect, and small tract planning.
- Be familiar with general terminology and definitions pertaining to the subject area.

Skills

- Know leaf morphology.
- Know the common tree species of the Adirondacks.
- Identify the layers of a tree cookie.
- Identify invasive species that impact Adirondack forests, and know their signs, symptoms, adverse impacts, and control methods.

- Measure diameter-at-breast-height of a tree with a Biltmore stick.
- Measure tree height using a clinometer.
- Know how to read a topographic map, and use a map and compass.
- Identify forestry hand and power tools, and planting tools.

Outline

I. Tree Physiology and Tree and Shrub Identification

A. Identify parts of a tree, including tissue of roots, stem, and leaves

B. Identify trees by leaves, bark, flower, or seed

II. Forest Ecology

A. Forest structure

B. Ecological concepts and terminology

1. Relationship between soil and forest type
2. Levels of succession

C. Factors influencing tree growth and forest development

1. Climate, insects, microorganisms, and wildlife

D. Forest Health

1. Identify common insects and diseases
2. Identify invasive species

III. Sustainable Forest Management

A. Silvicultural techniques: thinning, single tree or group tree selection, shelter wood, clear cutting, seed tree

B. Silviculture: clear-cutting, seed tree method, even aged management, uneven aged management, shelter wood and selection

C. Silviculture treatments: planting, thinning, harvesting

D. Forestry tools and equipment

1. Basal area
2. Diameter
3. Height

E. Factors influencing management decisions: ecological, financial, social

VI. Uses of Trees and Woods

A. Community trees – their values, threats to them and challenges growing them

B. Social and economic value

1. Products
2. Watershed protection
3. Wildlife

Sample Questions

1. What is a forest stand?

A - Early term for fire watch tower.

B - A numerical figure representing the capability of soil to grow trees.

C - A planting procedure to compact soil around a tree seedling to ensure good soil contact.

D - A group of trees with similar characteristics that are managed as a single unit.

2. Which of the following is **not** an introduced forest pest?

A - Gypsy moth B - Emerald ash borer
C - Forest tent caterpillar D - Asian long-horned beetle

3. What does the term “invasive species” mean?

A - Movement of a native species within its range based on range carrying capacity and climate changes.

B - Reintroduction of a plant or animal species into an ecosystem from which it had previously disappeared.

C - A non-native plant, animal or microbial species that, when introduced into an ecosystem, causes or is likely to cause economic, environmental or public health harm.

D - None of the above.

4. The "pioneer" stage in forest succession is

A - The forest condition encountered by the first white settlers.
B - The early successional stage when open land reverts to forest cover.
C - The regeneration of a mature forest after harvesting.
D - Development of undisturbed forests for human uses.

5. What is timber cruising?

A - The process of estimating the quality, quantity and characteristics of trees in a forest.

B - A historical reference to riding the logs down a river.
C - Aerial flights over the forest to identify pest infestations.
D - Patrolling a forest area to identify unauthorized activities.

6. What is the total amount of solid wood and air space contained in a standard cord?

A - 98 cubic feet B - 108 cubic feet
C - 128 cubic feet D - 118 cubic feet

7. Clearcutting in the Adirondacks requires a permit from the Adirondack Park Agency if it involves upland areas larger than

A - 10 acres B - 25 acres
C - 50 acres D - Is not permitted

8. What is the definition of basal area?

A - The actual land surface measure of one acre on a flat map.
B - The area of a forest stand measured from a flat map.
C - The measure of area occupied by the root system of a tree.

D - A measure of relative tree population density of a stand of trees growing on an acre of ground.

9. An increment borer is used to do what?
   A - To determine the diameter of wood borer bark exit holes.
   B - To sample tree bark for nutrient deficiency.
   C - To determine average annual tree growth.
   D - To determine the number of sample plots for a timber stand cruise.

10. What is the standard measure of tree volume?
   A - Basal area B - Ton
   C - Board foot D – Cord

Glossary

Aesthetics - forest value, rooted appreciation, affording inspiration, contributing to the arts, and providing a special quality of life.

Afforestation - the establishment of forest trees by planting or seeding an area not previously forested.

Alluvial soils - soil formed from material such as gravel, sand, of water and showing little of no modification of the original material by soil forming processes.

Area sensitive species - plants or animals with very specific habitat requirements that are susceptible to population decline when their habitat is altered.

Aspect - the orientation of a slope with respect to the compass; the direction toward which a slope faces; north facing slopes are generally cooler than south facing slopes.

Basal area – is a measurement of the cross-sectional area of a tree trunk in square feet at breast height. If a forest stand is the sum of the individual trees, and is reported as BA per acre.

Biological diversity - the variety of plants and animals, the communities they form and the ecological functions they perform at the genetic, stand, landscape, and regional levels.

Biological maturity - the point in the life cycle of a tree at which there is not net biomass accumulation; the stage before decline when annual growth is offset by breakage and decay.

Board foot - a unit of wood 1 inch thick, 12 inches long, and 12 inches wide. One board foot contains 144 cubic inches of wood. This is the standard measure of tree volume.

Browse - portions of woody plants including twigs, shoots, and leaves used as food by such animals as deer.

Buffer strips - forestland left relatively undisturbed to lessen visual or environmental impacts of timber harvesting, usually along a road or waterway.

Canopy - the upper level of a forest, consisting of branches and leaves of taller trees. A canopy is complete (or has 100 percent cover) if the ground is completely hidden when viewed from above the trees.

Clearcutting - a harvesting and regeneration technique that removes all the trees, regardless of size, on an area in one operation. Clearcutting produces an even-aged forest stand.

Cobblestone - a rounded or partly rounded fragment if rock, 3 to 10 inches in diameter.

Corridor - a strip of wildlife habitat, unique from the landscape on either side of it, that links one isolated ecosystem "island" (e.g. forest fragment) to another. Corridors allow certain species access to isolated habitat areas, which consequently contributes to the genetic health of the populations involved.

Covet - geographic unit of cover for wildlife (usually game); for example, a thicket or underbrush sheltering grouse or deer.

Crop tree - a term traditionally reserved to describe a tree of a commercially desirable species, with the potential to grow straight, tall, and vigorously. However, a crop tree can be one selected for non-timber purposes (varying with landowner objectives), such as mast production or den tree potential.

Crown class - an evaluation of an individual tree's crown in relation to its position in the canopy and the amount of full sunlight it receives. The four recognized categories are: dominant (D), co-dominant (C), intermediate (I), and overtopped or suppressed (S).

Cull - a tree of such poor quality that it has no merchantable value in terms of the product being cut. However, a timber cull tree may have value for wildlife or aesthetics.

dbh - diameter at breast height, or 4.5 feet above ground level. The abbreviation generally is written without capital letters and without periods.

Den tree - a tree with cavities in which birds, mammals or insects such as bees may nest (also known as cavity tree).

Dendrology – the study of the identification and classification of trees.

Diameter - limit cut - a timber harvesting treatment in which all trees over a specified diameter may be cut. Diameter limit cuts often over time reduce the quality of a forest stand significantly.

Disturbance - a natural or human-induced environmental change that alters one or more of the floral, faunal, and microbial communities within an ecosystem. Timber harvesting is the most common human disturbance. Windstorms and fire are examples of natural disturbance.

Economic maturity - the point in the life cycle of a tree or stand when harvesting can be most profitable, i.e., when the rate of value increase of an individual tree or stand falls below a desired alternative rate of return.

Ecosystem - a natural unit comprised of living organisms and their interactions with their environment, including the circulation, transformation, and accumulation of energy and matter.

Edge - the boundary between open land and woodland or between any two distinct ecological communities. This transition area between environments provides valuable wildlife habitat for some species, due to increase predation and parasitism.

Emergent wetlands - a class of wetland dominated by grasses, sedges, rushes, forbs, and other rooted, water-loving (possibly broad-leaved) herbaceous plants that emerge from water or soil surface; marshes are an example.

Endangered species - species in danger of extinction throughout all or a significant part of their range. Protection mandated by the United States Endangered Species Act, 1973.

Even-aged stand - a group of trees that do not differ in age by more than 10 or 20 years or by 20 percent of the rotation age.

Forest - a biological community dominated by trees and other woody plants.

Forest fragmentation - the breaking of large, contiguous, forested areas into smaller pieces of forest; typically these pieces are separated by roads, agriculture, utility corridors, subdivisions, or other human development.

Forest types - associations of tree species that commonly occur because of similar ecological requirements. Examples of major forest types are oak-hickory, northern hardwoods, Allegheny hardwoods and spruce-fir. Forested wetland - an area characterized by woody vegetation over 20 feet tall where soil is at least periodically saturated with or covered by water.

Fragipan - a dense and brittle pan, or layer, or soils. Its hardness results mainly from extreme density or compactness rather than from high clay content. The material may be dense enough to restrict root, nutrient, and water penetration.

Girdling - a method of killing unwanted trees by cutting through the living tissues around the bole. Can be used instead of cutting to prevent felling damage to nearby trees. Girdled trees can provide cavities and dead wood for wildlife and insects.

Glacial till - the unsorted part of glacial drift, consisting of clay, silt, sand, and boulders transported and deposited by ice.

Group tree selection – a method of regenerating uneven-aged stands in which trees are removed, and new age classes are established, in small groups. The maximum width of groups is approximately twice the height of the mature trees, with small openings providing

microenvironment suitable for tolerant regeneration and the larger openings providing conditions suitable for more intolerant regeneration. In the Group Selection System, the management unit or stand in which regeneration, growth, and yield are regulated consists of a landscape containing an aggregation of groups. (see Clearcutting)

Habitat - the geographically defined area where environmental conditions (e.g., climate, topography, etc.) meet the life needs (e.g., food, shelter, etc.) of an organism, population, or community.

Hardpan - a cemented or hardened soil horizon. This layer, which may be of any texture, is compacted or organic matter, or other substances.

High-grading - a type of timber harvesting in which larger trees of commercially valuable species are removed with little regard for the quality, quantity, or distribution of trees and regeneration left on the site; often results when a diameter limit harvest is imposed.

Improvement cut - any cutting treatment used to alter species composition and tree spacing to realize ownership objectives. Thinning is a type of improvement cut.

Invasive species - plants, animals, and other organisms either accidentally or intentionally introduced from other places that cause harm to the environment, economy, or human health.

Landscape ecology - the study of how ecological communities are arranged and interact with each other across the landscape

Mast - all fruits of trees and shrubs used as food for wildlife. Hard mast includes nutlike fruits such as acorns, beechnuts, and chestnuts. Soft mast includes the fleshy fruits of black cherry, dogwood, and serviceberry.

Neo-tropical birds - birds that breed in the northern hemisphere during summer months, and winter in tropical regions (e.g., woodthrush or barn swallows).

Old-growth - forests that approximate the structure, composition, and functions of native forests prior to European settlement. They vary by forest type, but generally include more large trees, canopy layers, standing snags, native species, and dead organic matter than do young or intensively managed forests.

Permeability, soil - the quality that enables water or air to move through the soil. Terms used to describe permeability are very slow, slow, moderate, rapid, and very rapid.

Pole stand - a stand of trees with dbh ranging from5 to 11 inches.

Reaction, soil - the degree of acidity or alkalinity of the soil, expressed in pH values or words.

Regeneration - the replacement of one forest stand by another as a result of natural seeding, sprouting, planting, or other methods; also young trees which will develop into the future forest.

Regeneration cut - a timber harvest designed to promote and enhance natural establishment of trees. Even-aged stands are perpetuated by three types of regeneration cuts: seed tree, shelterwood, and clearcutting. Uneven-aged stands are perpetuated by selecting individual or small groups of trees for removal (e.g., the selection system).

Release - removal of overtopping trees to allow understory or overtopped trees to grow in response to increased light.

Residual stand - trees remaining following any cutting operation.

Riparian zone - an area adjoining a body of water, normally having soils and vegetation characteristics of floodplains or areas transitional to upland zones. These areas help protect the water by removing or buffering the effects of excessive nutrients, sediments, organic matter, pesticides, or pollutants.

Salvage cut - the removal of dead, damaged, or diseased trees with the intent of recovering value prior to deterioration.

Sapling – a small tree, usually defined as being between 1 and 5 inches dbh.

Sawlog - a log large enough to yield lumber. Usually the small end of a sawlog must be at least 6 to 8 inches in diameter for softwoods and 10 to 12 inches for hardwoods.

Second growth - the forests re-establishment following the removal of virgin (i.e., previously unharvested) or old-growth stands. Much of New York's forests are either second or third growth.

Seed tree cut - a regeneration cut where mature trees are left standing in a harvested area to provide seed for regeneration of the cut-over site.

Seedling - a young tree originating from seed that is less than 4 feet tall and smaller than 2 inches in diameter at ground level.

Selection cut - a regeneration cut designed to create and perpetuate an uneven-aged forest. Trees may be removed singly or in small groups. A well-designed selection cut removes trees of lesser quality and trees in all diameter classes along with merchantable and mature high-quality sawlog trees. Should be differentiated from "select" or "selective" cuts, which often equate to high-grading.

Shelterwood - a regeneration cut designed to stimulate reproduction by removing all overstory trees. This is achieved by a series of cuts over several years. Gradual reduction of stand density protects understory trees and provides a seed source for stand regeneration.

Silviculture - the art and science of controlling the establishment, growth, composition, and quality of forest vegetation for the full range of forest resource objectives.

Single-tree selection - a method of creating new age classes in uneven-aged stands in which individual trees of all size classes are removed more-or-less uniformly throughout the stand to achieve desired stand structural characteristics.

Site - the combination of biotic, climatic, topographic, and soil conditions of an area; the environment at a location.

Site quality - the inherent productive capacity of a specific location (site) in the forest affected by available growth factors (light, heat, water, nutrients, anchorage); often expressed as tree height at a given age.

Slash - branches, tops, and cull trees left on the ground following a harvest. Although some of this material can be used for firewood, slash may be arranged in brush piles to provide wildlife cover. Left scattered, slash can protect seedling and sprouts from deer browsing and reduce soil erosion.

Snag - standing dead tree with few branches, or the standing portion of a broken-off tree. Snags may provide feeding and/or nesting sites for wildlife.

Species richness - the number of species present in a community or a defined area.

Spring seep - is a class of wetland created by groundwater emerging on lower slopes in small pools surrounded by vegetation. These create snow-free zones critical for wildlife feeding during winter.

Stand - a grouping of vegetation sufficiently uniform in species composition, age, and condition to be distinguished from surrounding vegetation types and managed as a single unit.

Stewardship - the wise management and use of forest resource to ensure their health and productivity for the future with regard for generations to come.

Stumpage - the commercial value of standing trees.

Succession - the natural series of replacements of one plant community (and the associated fauna) by another over time and in the absence of disturbance.

Texture, soil - is the relative proportions of sand, silt, and clay particles in a mass of soil.

Thinning - removal of trees to encourage growth of other selected individual trees. This may be commercial or pre-commercial.

Timber cruising - the process of estimating the quality, quantity, and characteristics of trees in a forest.

Timber stand improvement (TSI) - a combination of intermediate treatments designed to improve growth and composition of the forest; often spoken of as TSI.

Tolerance - a characteristic of trees that describes the relative ability to thrive with respect to the growth factors (light, heat, water, nutrients, anchorage). For instance, a "shade tolerant" species may thrive at low light levels.

Understory - the smaller vegetation (shrubs, seedlings, saplings, small trees) within a forest stand, occupying the vertical zone between the over story and the herbaceous plants of the forest floor.

Uneven-aged stand - a group of trees of various ages and sizes growing together on a site

Watershed - a region or area defined by patterns of stream drainage. A watershed includes all the land from which a particular stream or river is supplied.

Water holding capacity - is the ability of soil to hold water that will not drain away but can be taken up by plant roots.

Water table - is the upper limit of the part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Wetlands - area which are either transitional between land and water (where the water table is at or near the land surface) or areas of land which are covered by shallow.

Wolf tree - a large, excessively branchy tree which occupies more space in the forest than surrounding trees. Wolf trees have high wildlife and aesthetic value, but little if any timber value.

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What do Foresters Do?

Approximately half of our nation's forested land belongs to private owners, a little less than half belongs to the public and the rest is owned by industry. Foresters help to manage, develop and protect these precious areas. They are the stewards of the forest, making sure that it retains its beauty, soil and water quality and native wildlife. Foresters must also work to ensure that timber is sustainably harvested. They must learn to balance society's demand for wood-products with environmentally sustainable forest management and forest preservation strategies.

To become a forester one must attend a four year bachelor's degree program at an accredited university. Students study a multitude of disciplines, including biology, ecology, hydrology, sociology, economics, policy and history. Being a Forester requires good social skills, but also the ability to work alone. Foresters work in the lab, the office and the forest. Physically strenuous field work is often required and a love for the environment and nature is a must.
As a forester, one can work for the federal, state or local government, in the corporate sector, or privately as a consultant. One may work for the United States Forest Service (USFS), the Bureau of Land Management (BLM), or the United States Military, managing and protecting public lands. A government employee often works with fire protection, managing the forest's recreational uses, and monitoring wildlife. Foresters can work for Soil and Water Conservation Districts. A Forester may also be hired by the timber industry to create and implement timber

management plans, oversee forest health, and market the timber crop. Foresters also work for colleges and universities as faculty members and researchers.
A recent forestry graduate will earn between $25,000 and $30,000. As novice foresters gain more experience, salaries will rise, and masters and doctoral students can start off making as much as $45,000 to $60,000. As our national population grows, the need to manage the interface between development and forested land will increase, and the need for forestry knowledge and expertise will rise.

Soils

Introduction

There can be many uses of the word soil, depending on the context. For example, soil can be thought of as an engineering material for road construction, as dirt on clothing, as a mixture of ingredients for growing potted plants, or what the farmers plow every spring.

Soil is the collection of natural bodies on the earth's surface, in places modified or even made by humans of earthy materials, containing living matter and supporting or capable of supporting plants outdoors. Soil is thus considered both a product of nature and a critical part of natural systems. This definition also allows soils to be collectively grouped into a classification system, as used in making soil surveys.

Soils begin as parent material, and then the process of weathering occurs. Weathering eventually causes a differentiation into distinct horizons. A soil and its profile show the effects of five soil forming factors: Climate; Living Organisms; Topographic Relief; Parent Material; and Time. Remember CLORPT. Soils can be considered as young, mature or old, depending upon their extent of weathering and horizon development. Soils in New York State are relatively young or mature, but not old. Their parent material was exposed or deposited during the relatively recent retreat of glaciers, some 10 to 15 thousand years ago

There are a number of soil properties and limitations including: composition; texture; structure; slope; color; chemistry; profile; permeability; and drainage. In addition to defining and applying these soil properties for background, a practical knowledge of the soils can be attained by using the Soil Survey, which classifies soils into series for identification, and provides reference maps and interpretative tables.

Most of the soils in the United States are aerobic. But soils can often become saturated with water due to rainfall and flooding. When this anaerobic (no oxygen) environment continues for long periods during the growing season, different biological and chemical reactions begin to dominate. In soils where saturation with water is prolonged and is repeated for many years, unique soil properties usually develop. Soils with these unique properties are called hydric soils. These soils are important to the formation of many types of wetlands. In fact, hydric soils were defined so that they help identify wetlands.

Soil erosion and sedimentation are separate processes, but think of them as occurring together, since once soil is eroded, it will eventually become sediment impacting water quality somewhere else. Normally it takes an average of 500 years for nature to build up 1 inch of topsoil. To grow good crops agriculturally, 6 inches of topsoil are required. In the United States, topsoil is being built up naturally at an average rate of 1/500th per year. Soil is being depleted on the average each year approximately 18 times faster than it is being built up in nature (Ecology Action, 5798 Ridgewood Road, Willits, CA 95490).

Learning Objectives

- Utilize soil information, including a soil survey.
- Identify the four major components of soil.
- Recognize soil as an important and dynamic resource.
- Know the five soil forming factors, and understand how they influence soil properties.
- Understand the origin and types of soil parent materials and land forms.
- Understand basic soil forming processes: additions; losses; translocations; and transformations.
- Recognize and understand features of soil profiles and a soil pit, and be able to use this information to determine basic soil properties and limitations.
- Identify and describe soil characteristics: texture; structure; and color using Munsell color charts.
- Understand soil biological diversity and how it relates to soil health and hence plant, human and environmental health. Recognize that understanding soil ecosystems is important to soil management.
- Understand how the hydrologic, carbon and nutrient cycles relate to soil management.
- Understand that soil fertility relates to the physical and chemical properties of the soil in addition to the quantity of nutrients.
- Understand why soil fertility reflects the physical, chemical and biological state of soil.
- Compare different land uses and conservation practices and their impact on soils and erosion.
- Understand how soil is impacted by point and non-point source pollution and the practices used to address, reduce or eliminate the impact.
- Access and use published and on-line soil data and other resources to learn how land use affects soil, and the limitations of local soils.
- Understand Land Capability Classes and how they are important in determining appropriate land use.
- Understand soil drainage classes and be able to recognize the characteristics of hydric soils.
- Understand soil water, its movement, storage, and uptake by plants.
- Understand soil formation processes.
- Be familiar with general terminology and definitions pertaining to the subject area.

Skills

- Use of clinometers, augers, color charts, test kits, a textural triangle, and meters.

- Familiarity with soil pits and monoliths.
- Determine soil type by ribboning or use of particle screens.
- Basic ability to determine land use class.
- Identification of wetland indicators.
- Identify landform at site.
- Determine permeability of soil.
- Identify drainage class, depth to bedrock, and depth of rooting.
- Measure thickness of topsoil and subsoil.
- Analyze soil structure and texture.
- Ability to quickly and effectively locate needed information in a soil survey.
- Use soil survey to: identify hydrologic soil group; analyze chemical properties of soil; estimate erosion potential; identify soil-mapping unit; evaluate soil type for its suitability for crops and pasture, woodland productivity, wildlife habitat, recreation, building site development and sanitary facilities.
- Determine soil characteristics and properties by describing soil horizons from a soil test pit.
- Use the web-soil survey, learn the limitations that local soils have for septic systems, foundations, agriculture, and future development: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Outline

I. Soil: what is it?
   A. Definition
   B. Development
      1. parent material
      2. processes of development
      3. land forms

II. Characteristics
   A. Composition
   B. Texture
   C. Structure
   D. Slope
   E. Color
   F. Chemistry
   G. Horizons / profile
   H. Permeability / percolation
   I. Soil water and drainage

III. Soil Surveys (know how to use this information
   A. Soil series
      1. what are they
      2. how to use them

the texture

IV. Soil Interpretations (know how to use this information)
   A. Agriculture
   B. Forestry
   C. Development
   D. USDA land use classification
      1. prime soils

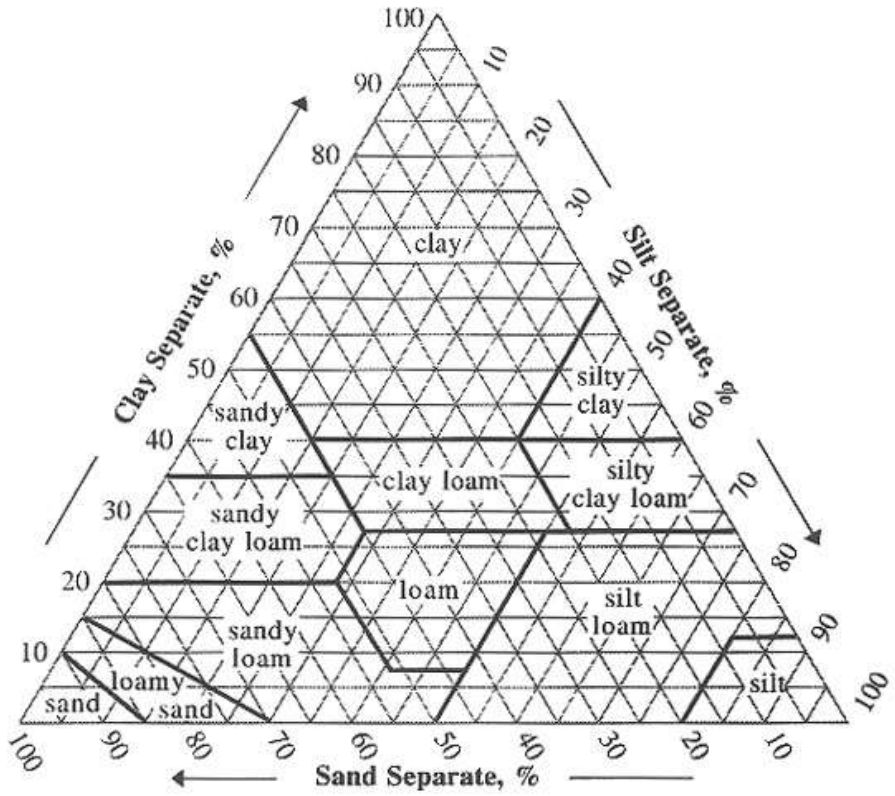
V. Erosion and Sedimentation
   A. Definitions
   B. Types of erosion
   C. Economic impacts
   D. Prevention
      1. principles
      2. agricultural conservation practices
      3. nonagricultural conservation practices

VI. Hydric Soils
   A. Definition
   B. Characteristics
   C. Uses / limitations
   D. Economic value

a. loam
b. sandy clay loam
c. silty clay loam
d. clay

2. An "ideal soil" has
   a. 55% mineral material, 45% organic matter, and 5% pore space (air and water)
   b. Equal amounts (25%) of air, water, mineral and organic material
   c. 45% mineral material, 50% organic matter, and 5% pore space (air and water)
   d. 45% mineral material, 5% organic matter, and 50% pore space (air and water)

Use the diagram below to answer question 3.



3. Which of the following best describes the soil forming process occurring in the "A" Horizon of undisturbed soil profile?
   a. Additions of organic matter from decomposing plant materials
   b. Loss of iron, clay and aluminum and additions of organic matter by soil organisms
   c. Accumulation of iron, clay, and aluminum through translocation.
   d. Transformations of parent material through weathering or disintegration.

4. The five soil forming factors are:
   a. Rock minerals, climate, organisms, relief and time
   b. Parent Material, environment, organisms, relief and time

c. Parent Material, climate, organisms, relief and time
d. Parent Material, environment, organisms, elevation and time.

5. A 1% increase in organic matter content in soils results in as much as _____gallons of available soil water per acre
a. 250
b. 2,500
c. 25,000
d. Organic matter increases do not affect water holding capacity, only clay content

6. Parent material, consisting of un-stratified soil with angular rock fragments is called
a. alluvium
b. colluvium
c. till
d. outwash

7. What soil color is indicative of a very wet soil where microbial and chemical processes have reduced iron from the ferric to the ferrous form?
a. Blue-grey
b. Brown
c. Yellow
d. Red

8. Generally, which soil is most prone to erosion by water:
a. Clay with low organic matter
b. Silt loam with low organic matter
c. Silty clay loam with moderate organic matter
d. Sandy loam with moderate organic matter

For the next two questions, use the Soil Resource Report for Hamilton County, New York generated utilizing Web Soil Survey: http://websoilsurvey.nrcs.usda.gov/

9. Which of the following soil map units has the lowest T? (Erosion factor: tolerable soil loss: maximum average annual rate of soil erosion by wind /water that can occur without affecting crop productivity over a sustained period, rate is in tons per acre per year).
a. 24A: Bucksport
b. 653C: Monadnock
c. 723D: Becket
d. 831C: Lyman

10. Which soil is Frequently or Occasionally Ponded?
a. n 24A: Bucksport
b. 723D: Becket
c. 727B: Adirondack
d. 831C: Lyman

11. True or False:

a. Available water holding capacity is the amount of water that a soil can store and release to plant roots.

b. The physical condition of a soil as related to its ease of tillage, fitness as a seedbed and impedance to seedling emergence and root penetration is called tilth.

c. Calcium is a soil macronutrient.

d. In a pine stand, the soil pH is generally acidic.

e. All soils will produce trees of commercial value.

f. Terrace soils refer to those soils formed in old alluvial sediments.

g. Potassium is an essential plant nutrient that is the most easily leached from the soil.

h. The presence of mottles in a soil profile indicates impeded soil drainage.

i. You would expect a soil classified as montmorillonitic to have high organic matter.

j. Munsell soil color notations are comprised of hue, value, and chroma.

k. Generally the deeper the soil, the greater the site index.

l. A field is made up of only one type of soil.

m. If harvesting were taking place, clayey soils would compact the most under normal harvest operations.

n. Soils high in coarse fragments are harder to compact than fragment free soils.

0. Wind may move soil particles by abrasion.

p. If a soil profile exhibits relatively thin layers of light and dark colored materials stratified approximately parallel to the surface, it is likely that the soil is located on a floodplain.

Glossary

Acre - a unit of measurement of land. It is equal to the area of land inside a square that is about 209 feet on each side (43,560 square feet).

Additions - materials added to the soil, such as decomposing vegetation and organisms (organic matter--OM), or new mineral materials deposited by wind or water.

Bacteria - microscopic organisms that live on water and on land. They help break down organic materials into simpler nutrients in a process called decay. Bacteria release nutrients to the soil.

Bedrock - a more or less solid layer of rock found on the surface of the land or below the soil.

Biodiversity - the variety of life in the world or in a particular habitat or ecosystem.

Carbon cycle - the series of processes by which carbon compounds are interconverted in the environment, chiefly involving the incorporation of carbon dioxide into living tissue by photosynthesis and its return to the atmosphere through respiration, the decay of dead organisms, and the burning of fossil fuels.

Complex, Soil - map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Contour stripcropping - growing crops in strips that follow the contour. Strip of grass or close-growing crops are alternated with strip of clean-tilled crops or summer fallow.

Drainage class - refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets.

Eluviation - the movement of material in true solution of colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion - involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity.

Evaporation - changing a liquid to a gas; for example, when water turns into steam or water vapor.

Fungi (plural of fungus) - group of non-green plants, such as molds, and mushrooms, that live on dead or dying organic matter. Fungi release nutrients to the soil.

Humus - highly decomposed plant and animal residue that is a part of soil.

Hydrologic cycle - the cycle of water movement from the atmosphere to the earth and back again through these steps; evaporation, transpiration, condensation, precipitation, percolation, runoff and storage.

Hydric soil - a soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part.

Illuviation - the movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Land capability classes – groups of soils that show, in a general way, the suitability of soils for most kinds of field crops.

Leaching - the removal of soluble minerals from soil by the downward movement of water.

Losses - through the movement of wind or water, or uptake by plants, soil particles (sand, silt, clay, and OM) or chemical compounds can be eroded, leached, or harvested from the soil, altering the chemical and physical makeup of the soil.

Mineral - a naturally occurring inorganic substance with definite chemical and physical properties and a definite crystal structure.

Mottling, soil - irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage.

Munsell notation - designation of color by degrees of three simple variables: hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and Chroma of 4.

Nematodes - microscopic, elongated worms that live on other organisms in the soil.

Nonpoint source pollution (NPS) - pollution that originates from many diffuse sources and usually is not regulated, such as runoff from streets that carries with it oil, feces and sediment.

Nutrient - a substance that supplies nourishment for an organism to live. It can be food or chemical depending upon the organism.

Nutrient exchange - the process by which plant roots exchange an acid for nutrients from the soil.

Organic matter - plant and animal material in various stages of decomposition that may be part of the soil.

Parent material - the earthy materials both mineral and organic, from which soil is formed.

Percolation - the downward movement of water in soil.

Permeability - the quality of soil that allows air or water to move through it.

pH value - a numerical designation of acidity and alkalinity in soil. (See Reaction, soil)

Point source pollution - Pollution that is discharged through a pipe or other conduit and is usually a regulated discharge.

Pore spaces - the area of the soil through which water and air move. The space between soil particles.

Precipitation - rain, snow, and other forms of water that fall to earth.

Reaction, soil – a measure of acidity or alkalinity of a soil. expressed in pH-values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline.

Regolith - the unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Rock Fragments – rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root Zone - the part of the soil that can be penetrated by plant roots.

Runoff - water that flows off land into streams and other waterways.

Sand - as a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85% or more sand and not more than 10% clay.

Sedimentation - the action or process of forming or depositing sediment.

Silt - as a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 mm) to the lower limit of very fine sand (0.05 mm). As soil textural class, soil that is 80% or more silt and less than 12% clay.

Soil - a naturally occurring mixture of minerals, organic matter, water and air which has definite structure and composition and forms on the surface of the land.

Soil color - the color of a sample of soil.

Soil horizon - a layer of soil that is nearly parallel to the land surface and is different from layers above and below.

Soil mineral - that portion of the soil that is inorganic and neither air nor water.

Soil series - a group of soils with similar profiles developed from similar parent materials under comparable climatic and vegetational conditions

Soil survey - the identification, classification, mapping interpretation and explanation of the soil.

Soil texture - the relative amounts of sand, sift, and clay in a given soil sample.

Solum - the upper part of the soil profile, which is influenced by plant roots; the A horizon and the B horizon.

Subsoil - technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum - the part of the soil below the solum.

Subsurface layer - any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer - the soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the plow layer, or the Ap horizon.

Top soil - the upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to top dress road banks, lawns, and land affected by mining.

Transformations - the chemical weathering of sand and formation of clay minerals, transformation of coarse OM into decay resistant organic compounds (humus).

Translocations - movement of soil constituents (organic or mineral) within the profile and/or between horizons. Over time, this process is one of the more visibly noticeable as alterations in color, texture, and structure become apparent.

Zone of accumulation - the layer in a soil into which soluble compounds are moved and deposited by water.

Zone of decomposition - surface layers in a soil in which organic matter decays.

Zone of leaching - the layers in a soil from which soluble nutrients are removed by water.

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What do Soil Scientists Do?

The terrestrial ecosystem relies on the soil as a foundation from which to build. Soil Scientists teach people what soil is and how it interacts with other components of our ecosystem. They

study and research soil formation, classification and engage in soil mapping (i.e.; soil surveys). They investigate the chemical and biological properties of soil and how these support life above ground. They also strive to find sustainable management and usage guidelines which will benefit crop production, environmental quality, waste management, recycling and wildlife.

Soil Scientists often work for the federal government but also find work with non-profit environmental groups, consulting firms or private practice. In the government sector, soil scientists can work for the Natural Resources Conservation Service (NRCS) or a state's environmental agency. They work on comprehensive soil surveys and interact with the public, offering tips on the best management practices for land use, plant growth and erosion control. Soil Scientists often act as consultants working with engineers on construction projects or technicians on soil problems, and often they deal with waste management and groundwater issues. Soil Scientists spend much of their time outdoors, conducting soil testing and gathering information about the relationship between different soil properties and plant growth.

Soil Scientists require at least a four year bachelor's degree from an accredited university, and usually a master's degree or higher to work in research positions. Students will study a range of disciplines including biology, geology, chemistry and hydrology. Recent graduates often make between $30,000 and $50,000 per year. Soil Science is integral to understanding the world we live in and to supporting the health of our ecological community. The demand for Soil Scientists will be steady as our nation strives to live in sustainable harmony with our environment.

Wildlife

Introduction

Along with aquatics, forestry and soils, wildlife is another of our valuable natural resources. Wildlife are highly dependent upon the status of aquatic, forestry and soil ecology. Today, the greatest threat to wildlife is habitat loss. The impact of human land use practices on wildlife populations and their habitats is a major concern nationwide.

The wildlife station will emphasize animal wildlife in the Adirondacks. Students will be expected to have a basic understanding of regional species populations and their habitats, how they function and change over time, and their role in the ecosystem. They should be able to identify common wildlife species and their corresponding characteristics and habitats. In addition, the wildlife learner should develop an awareness and knowledge of the following: specific adaptations of wildlife to their environment; wildlife survival needs; predator/prey relationships; food chains and food webs; trophic levels; factors that limit or enhance population growth; concepts of carrying capacity and limiting factors; non-native invasive species; threatened and endangered species; and the roles of both the public and wildlife managers in the protection, conservation, management, and enhancement of wildlife populations.

Learning Objectives

- Identify general food habits and habitats from teeth and skull morphology.
- Know the preferred habitat types and specific habitat requirements of Adirondack wildlife species and the factors that affect wildlife suitability.
- Know and understand basic ecological concepts and terminology including the difference between an ecosystem, community and population.
- Understand wildlife population dynamics and limiting and decimating factors of wildlife management.
- Be able to identify, describe and explain adaptations of wildlife to their environment.
- Identify common wildlife management practices and methods that are being used to manage and improve wildlife habitat.
- Understand the role of federal and state Fish and Wildlife Agencies in the management, conservation, protection, and enhancement of fish and wildlife and their habitats.
- Be familiar with finding information found within the New York State hunting safety guide and hunter education program.
- Understand the environmental impact of invasive species, threat to biodiversity, and impact on native wildlife.
- Discuss the concept of carrying capacity and limiting factors.
- Understand common land use decisions that affect wildlife population growth, environmental degradation, and habitat reduction.
- Be familiar with common wildlife diseases including microbes, parasites, toxins, and other biological and physical agents.
- Understand the terminology and factors that affect threatened and endangered wildlife species. Know examples of Adirondack species that are extinct, extirpated, endangered, threatened, and special concern.
- Understand the role of the Endangered Species Act in helping to conserve endangered and threatened species.
- Know the organizations and agencies responsible for listing and protecting endangered species on global, federal, and state levels.
- Describe predator/prey relationships and identify examples.
- Describe food chains, food webs, and trophic levels.
- Be familiar with general terminology and definitions pertaining to the subject area.

Skills

- Identify Adirondack mammal, bird, amphibian, reptile, and insect species using mounted specimens, skins, pelts, pictures, skulls, silhouettes, decoys, wings, feathers, scats, tracks, animal sounds, or other common signs.
- Read and interpret growth rate graphs.
- Read and interpret predator – prey population graphs.

Outline

I. Identification of Adirondack wildlife species

A. Identify Adirondack wildlife species by specimens, skin / pelts, pictures, skulls, silhouettes, decoys, wings, feathers, scat, tracks, animal sounds, or other common signs

B. Identify general food habits and habitats from teeth and / or skull morphology

C. Specific habitats of the above

II. Wildlife Ecology

A. Basic ecological concepts and terminology

B. Wildlife population dynamics

1. Carrying capacity
2. Limiting factors

C. Adaptations of wildlife

1. Anatomical, physiological, behavioral

G. Biodiversity

1. Genetics, species, ecosystem, community

III. Wildlife Conservation and Management

A. Common management practices and methods

1. Conservation
2. Protection
3. Enhancement

B. Hunting regulations

C. Land conflicts with wildlife habitat needs

D. Factors influencing management decisions

1. Ecological
2. Financial
3. Social

E. Legislation

IV. Issues Involving Wildlife and Society

A. Invasive and non-native species

1. Examples in the Adirondacks
2. Environmental Impact

B. Endangered, Threatened, and Species of Concern

1. Examples native to the Adirondacks
2. Habitat requirements
3. Legislation
4. Terminology and factors

C. Diseases commonly found in the Adirondacks

<u>Sample Questions</u>

1. From which of the following animals are you most likely to contract rabies?
   a. American crow
   b. Northern pike
   c. spotted salamander
   d. meadow vole
2. Which of the following birds does *not* currently have a hunting or trapping season in New York State?
   a. mourning dove

b. Virginia rail
c. ruffed grouse
d. green winged teal

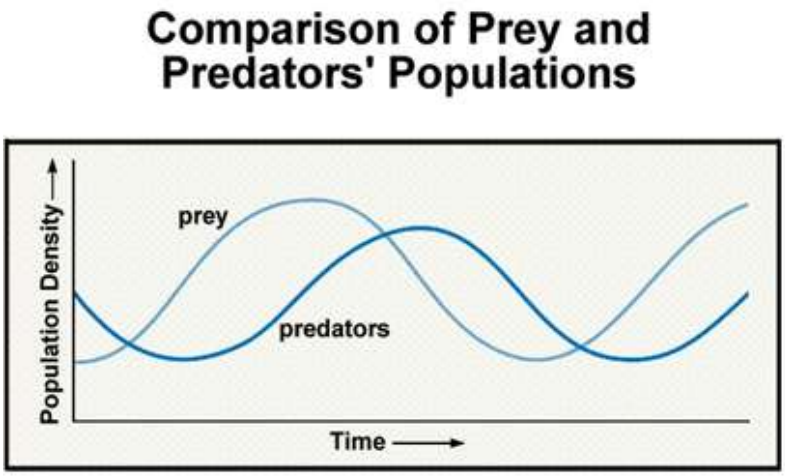
3. A keeled sternum is an anatomical adaptation of mammals in which of the following orders?
a. Carnivora
b. Chiroptera
c. Rodentia
d. Monotremata

4. All of the following factors contribute to extinction of a species EXCEPT:
a. Low reproduction rate
b. A fixed migration pattern
c. Preys upon livestock or people
d. Sensitivity to disease in select individuals of the species

5. A bull moose charging a smaller bull moose to drive him away is an example of:
a. mutualism
b. parasitism
c. commensalism
d. competition

6. A preservation-based outlook states that:
a. the environment and its resources should be used by humans and managed in a responsible manner.
b. the environment, lands and their natural resources should not be consumed by humans and should instead be maintained in their pristine form.
c. the use of animal products is cruel and unnatural.
d. all wild spaces should be accessible by the public

Refer to the following diagram for question #7.



7. All of the following statements concerning characteristics of predator-prey relationships are correct EXCEPT:

a. A rise in the population of prey is often followed by a rise in the population of predators.
b. A rise in the population of predators is followed by a decrease in the population of prey.
c. Camouflage is an adaptation that protects prey.
d. The population of predators most often eliminates the population of prey.

8. Which Adirondack amphibian is being described?

- Brown in color with a dark "X" shape on the back
- Emits a high pitched, chirping noise during the spring
- Widespread and common, found in or near bodies of freshwater

a. red backed salamander
b. Eastern garter snake
c. spring peeper
d. bullfrog

9. As you travel further up the food chain, the concentration of toxins in body tissues increases. This is known as:

a. pollution
b. biomagnification
c. bioaccumulation
d. toxicity index

10. A cross between two gray squirrels results in 50% of the offspring exhibiting gray fur and 50% of the offspring exhibiting white fur. If the allele for gray fur is G (dominant) and the allele for white fur is g (recessive), what were the genotypes of the parents?

a. GG x GG

b. GG x gg
c. Gg x gg
d. Gg x Gg

Glossary

Abiotic – a non-living factor in an environment i.e. light, water, temperature.

Aestivation – dormancy, generally seasonally.

Accipiter –a hawk of the genus Accipiter, characterized by short wings and a long tail.

Aquatic – growing, living in or frequenting water.

Arboreal – tree dweller.

Autotroph – an organism capable of manufacturing its own food by synthesis of inorganic materials, as in photosynthesis.

Bergman's rule – among forms of a particular species, body size tends to be larger in the cooler regions of its range and smaller in the warmer regions.

Bioaccumulation - the accumulation of a substance (as a pesticide) in a living organism.

Biodiversity - the variety of life in the world or in a particular habitat or ecosystem.

Biomagnification - the process by which a compound (such as a pollutant or pesticide) increases its concentration in the tissues of organisms as it travels up the food chain. Fish accumulate mercury more rapidly than they excrete it, and every fish up the aquatic food chain contains more than the one it just ate.

Brood – the offspring of a bird just hatched.

Browse – (v) to eat the twigs and leaves of woody plants; (n) commonly used in wildlife management to signify brushy plants utilized by deer.

Buteo – any of the various hawks of the genus Buteo, characterized by broad wings and broad, rounded tails.

Carapace – the upper or dorsal surface of a turtle's shell.

Carnivore – an animal belonging to the order Carnivora, including predominantly meat-eating mammals.

Carrion – the bodies of dead animals usually found in nature in a decaying state.

Carrying capacity – the number of wildlife species that a given unit of habitat will support without damage to the habitat.

Cast – to regurgitate indigestible prey remains.

Circadian – designating a biological period of about 24 hours.

Climax stage – the final stage of plant succession.

Commensalism - a relationship between individuals of two species in which one species obtains food or other benefits from the other without either harming or benefiting the latter.

Competition - the process of interaction between social groups, each seeking to gain access to a limited supply of the necessities of life, such as living space.

Conservation - the environment and its resources should be used by humans and managed in a responsible manner.

Consumptive use – any use that involves activity resulting in the loss of wildlife i.e. hunting.

Contiguous forests – forests that share an edge or boundary, touching.

Coverts – one or more of a group of feathers covering the bases of the longer main feathers of a bird's wings or tail.

Covey – a small group or flock, often a family group, of birds such as quail.

Crepuscular – appearing or becoming active at twilight or dawn.

Clutch – eggs laid and incubated by a female bird per nesting.

Corridor – areas of continuous habitat that permit animals to travel securely from one habitat to another.

Dabbling ducks – duck species that principally feed in shallow water by "tipping up" or dabbling on the surface.

Den - for bears, can be a hollow tree or log, under roots or a brushpile, or a crevice between or under boulders.

Depredation – the act of preying upon. Mostly wildlife damage to farmer's crops.

Diurnal – a term used to describe an animal that is most active by day.

Diving ducks – duck species that feed principally by diving below the surface.

Dorsal – of or pertaining to the upper surface.

Dump nest – eggs deposited by more than one female in a single nest.

Edge – the place where two or more different plant communities, successional stages or vegetative stages come together or meet.

Endangered Species - plants or animals that are native to New York and that are in imminent danger of extirpation or extinction here and that are listed as endangered in Section 182.5 of the Environmental Conservation Law § 11-0535 (animals including mollusks, insects, fishes, birds, and mammals), 6 NYCRR 193.3 (plants) or that are listed as endangered by the United States Department of the Interior in the Code of Federal Regulations (50 CFR part 17).

Endemic – confined to a certain area or region.

Enhancement – an activity conducted to increase or decrease a specific function for the purpose of benefitting species.

Estivation – a state of inactivity during prolonged periods of drought or high temperatures.

Exotic – not a native species. Was either introduced or escaped.

Flyway – fly routes established by migratory birds.

Food chain or food web – the relationship between autotrophs, herbivores, and carnivores.

Forest Game – game species that are managed by the DEC whose habitat needs are found mainly in forests.

Furbearers – various animals that have a thick coat of soft hair covering their bodies. The New York DEC regulates the harvesting of 14 furbearing species: red and gray fox, coyote, bobcat, raccoon, skunk, mink, weasel, and opossum.

Guard hairs – long, coarse hairs that forms a protective coating over an animal's under fur.

Harriers –any of the various slender, narrow-winged hawks of the genus Circus, which prey on small animals.

Harvest – proportion or number of a wildlife population brought to bag by hunters; in wildlife management, killing an animal.

Herbivore – an animal that eats plants.

Herpetology – the scientific study of reptiles and amphibians as a branch of Zoology.

Hibernation – passing the winter or a portion of it in a state of sleep

Home Range – the area an animal travel in when looking for food, shelter or a mate

Humus – material resulting from decayed plant and animal matter. It provides nutrients for plants and helps keep water in the soil.

Indigenous – a naturally occurring species.

Indicator species - an organism whose presence, absence or abundance reflects a specific environmental condition.

Insectivore – a mammal or organism that feeds on insects.

Inventory – the process of counting or identifying animals.

Keel – a ridge down the back or along the plastron of a turtle or a longitudinal ridge. On a dorsal scale in certain snakes.

Lateral – pertaining to the side.

Limiting factor – anything that affects a species population. It could result from causes in nature as well as human activities. Examples include food, water, shelter, space, disease, predation, climatic conditions, pollution, hunting, poaching and accidents.

Litter – the number of young born with each birthing.

Mandibles – either the upper or lower part of the beak in birds.

Marsupial - a mammal of the order Marsupialia that includes kangaroos, opossums, bandicoots and wombats. These animals have pouches that contain mammary glands and that shelter the young until fully developed.

Melanistic – abnormally dark pigmentation of the skin or other tissues. Black pigmented.

Migratory Game Bird - all wild ducks, geese, and brant. These also are migratory waterfowl. Coot, Virginia rails, sora rails, and gallinules, woodcock and snipe.

Molt – the process of shedding or replacing feathers.

Monogamous –term used when one male breeds with one female.

Mortality (death rate) – the number of animals that die each year.

Mutualism - association between organisms of two different species in which each benefits. Mutualistic arrangements are most likely to develop between organisms with widely different living requirements.

Natality (birth rate) – ability of a population to increase; reproductive rate.

Niche – that part of a habitat particularly suited to the requirements of a given species.

Nocturnal – active by night; the opposite of diurnal.

Nonconsumptive use – any use that does not directly kill wildlife, i.e. bird watching, hiking, photography.

Omnivore – an animal or organism that feeds on both animal and plant matter.

Ornithology –the scientific study of birds as a branch of zoology.

Parasite – an organism that lives by deriving benefit (usually doing harm) from another organism.

Parasitism - relationship between two species of plants or animals in which one benefits at the expense of the other, sometimes without killing the host organism.

Passerine – birds of the order Passeriformes, which include perching birds and songbirds such as the jays, blackbirds, finches, warblers and sparrows.

Pelage – the coat of a mammal, consisting of hair, fur, wool or other soft covering, as distinct from bare skin.

Philopatry – annual homing to the same nesting area and often the same nest site.

Plastron – the ventral surface of the shell of a turtle or tortoise.

Polygamy or polygyny – term used when a male animal breeds with many females.

Population – the number of a particular species in a defined area.

Population dynamics – factors regulating population levels including natality, productivity and mortality.

Preservation - lands and their natural resources should not be consumed by humans and should instead be maintained in their pristine form.

Protection – a person or thing that prevents someone or something from suffering harm or injury.

Recruitment – addition of a number of young to an adult population of breeders.

Riparian area – the area of influence between upland habitats and aquatic habitats.

SAV (submerged aquatic vegetation) – vascular plants that live and grow completely underwater.

Scat – the excrement droppings of an animal.

Species – populations of animals that possess common characteristics and freely interbreed in nature and produce fertile offspring.

Species richness – the number of wildlife species found in a given area.

Taxonomy – the science of the classification of animals or plants.

Torpor – temporary loss of all or part of the power of motion.

Trophic level – a feeding level in the food chain of an ecosystem characterized by organisms that occupy a similar functional position in the ecosystem.

Upland game – game species that are managed by the DEC whose habitat needs are usually found in upland areas.

Ventral – of or pertaining to the lower surface.

Waterfowl – water birds, usually referring to ducks, geese and swans.

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What do Wildlife Biologists Do?

Wildlife Biologists are scientists that observe and study the behaviors of animals. They frequently observe the features of certain wildlife and determine the creatures' role in specific ecosystems and/or how they interact with human beings. In addition, they will often perform various experiments to either increase our knowledge about a certain species or see how humans influence the ecosystem in question.

Many Wildlife Biologists will eventually specialize into a particular area of study defined by ecosystem or species. Some of these fields include: Entomology, Ornithology, Marine Biology, or Limnology.

Wildlife Biologists are extremely important to preserving the current state of our environment and deepening our understanding of the other creatures that share our planet with us.

Becoming a Wildlife Biologist is a fantastic position for someone who enjoys spending time outdoors and traveling. Many Wildlife Biologists spend the majority of their time working in the field, observing animals in their natural habitats. Some Wildlife Biologists work in labs or offices, but many only find themselves in these locations for small amounts of time. This is the perfect career for an adventurer who likes to work in a variety of environments.

Wildlife Biologists often cite physical exhaustion and loneliness as the top job hazards. They may be required to spend time in remote areas without modern conveniences and work long hours for observational purposes. Some kinds of work will require you to have limited contact with other people, possibly straining relationships and personal emotions.

However, it's important to note that Wildlife Biologists do not always work alone. In fact, many of them work on research teams, meaning that they may unite with colleagues at the end of an observation period to discuss findings. According to the Bureau of Labor Statistics, the average

Wildlife Biologist's salary is $57,710. Most Wildlife Biologists work full-time with the potential to work overtime or evening hours depending on their subject of study.

Current Issue

Introduction

As a by-product of its robust population, New York is faced with the responsibility of managing different types of waste generated by individuals, households, communities, businesses, manufacturing, agriculture, and industry. Waste of all kinds has the potential to affect the environment and our natural resources. From the water we drink to the land we live on, our decisions about how to manage waste impact our communities and the world around us. How can we make responsible choices about our waste? How can we manage our growth in a way that is sustainable? How can we turn our waste into resources?

These challenges make New York well positioned to enact innovative and creative solutions for managing its wastes, turning them into resources through restoration, repurposing, and recycling for the benefit of the natural environment and future generations.
Students will learn the concepts of different waste streams and the impacts of waste generation and disposal on natural resources and society. Students will also learn effective ways to manage waste regeneratively; as well as the social, economic, and political impacts of turning waste products and degraded lands into resources.

Learning Objectives

Key Topic 1: Landfills and Hazardous Material

1. Describe different types of landfills and explain how they are regulated
2. Identify examples of hazardous materials and toxic substances and describe their proper disposal and handling

Key Topic 2: Reuse, Recycling and Waste Treatment

1. Explain how the practice of reusing or recycling products conserves natural resources
2. Describe how recycled materials can be repurposed and further diverted from landfill
3. Explain how waste can be repurposed
4. Identify examples of closed loop energy system facilities
5. Compare methods of carbon sequestration and describe its potential as an energy source
6. Evaluate the differences between municipal waste treatment and home sewage treatment systems

Key Topic 3: Composting and Food Waste

1. Describe composting processes and identify how composting supports waste diversion efforts
2. Explain how composting improves soil health and provide evidence for how composting supports water conservation efforts
3. Describe the problem of food waste and explain how it impacts the sustainability of the global food supply

Glossary

Hazardous Waste - The hazardous waste management program uses the term solid waste to denote something that is a waste. EPA developed hazardous waste regulations that define in more detail what materials are solid waste for the purposes of RCRA Subtitle C (hazardous waste) regulation. Simply defined, a hazardous waste is a waste with properties that make it dangerous or capable of having a harmful effect on human health or the environment. Hazardous waste is generated from many sources, ranging from industrial manufacturing process wastes to batteries and may come in many forms, including liquids, solids gases, and sludge.

Household Hazardous Waste (HHW) - EPA considers some leftover household products that can catch fire, react, or explode under certain circumstances, or that are corrosive or toxic as household hazardous waste. Products, such as paints, cleaners, oils, batteries, and pesticides can contain hazardous ingredients and require special care when you dispose of them.

Landfills - Landfills are excavated or engineered sites where non-liquid hazardous waste is deposited for final disposal and covered. These units are selected and designed to minimize the chance of release of hazardous waste into the environment. Design standards for hazardous waste landfills require:

· Double liner

· Double leachate collection and removal systems

· Leak detection system

· Run on, runoff, and wind dispersal controls

· Construction quality assurance program

Operators must also comply with inspection, monitoring, and release response requirements. Since landfills are permanent disposal sites and are closed with waste in place, they are subject to closure and post-closure care requirements including:

· Installing and maintaining a final cover

· Continuing operation of the leachate collection and removal system until leachate is no longer detected

· Maintaining and monitoring the leak detection system

· Maintaining ground water monitoring

· Preventing storm water run on and runoff

· Installing and protecting surveyed benchmarks

Solid Waste - RCRA states that "solid waste" means any garbage or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, resulting from industrial, commercial, mining, and agricultural operations, and from community activities. Nearly everything we do leaves behind some kind of waste.

It is important to note that the definition of solid waste is not limited to wastes that are physically solid. Many solid wastes are liquid, semi-solid, or contained gaseous material.

A solid waste is any material that is discarded by being:

· Abandoned: The term abandoned means thrown away. A material is abandoned if it is disposed of, burned, incinerated, or sham recycled.

· Inherently Waste-Like: Some materials pose such a threat to human health and the environment that they are always considered solid wastes; these materials are considered to be inherently waste-like. Examples of inherently waste-like materials include certain dioxin-containing wastes.

· A Discarded Military Munition: Military munitions are all ammunition products and components produced for or used by the U.S. Department of Defense (DOD) or U.S. Armed Services for national defense and security. Unused or defective munitions are solid wastes when:

o abandoned (i.e., disposed of, burned, incinerated) or treated prior to disposal;

o rendered nonrecyclable or nonusable through deterioration; or

o declared a waste by an authorized military official. Used (i.e., fired or detonated) munitions may also be solid wastes if collected for storage, recycling, treatment, or disposal.

· Recycled in Certain Ways: A material is recycled if it is used or reused (e.g., as an ingredient in a process), reclaimed, or used in certain ways (used in or on the land in a manner constituting disposal, burned for energy recovery, or accumulated

speculatively). Specific exclusions to the definition of solid waste are listed in the Code of Federal Regulations (CFR) at 40 CFR section 261.4(a). Many of these exclusion are related to recycling.

Materials that do not meet this definition are not solid wastes and are not subject to RCRA regulation.

MSW Composting Glossary
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Extracted from a variety of sources or developed by the authors and presented for the convenience of the reader.

AERATED STATIC PILE: composting system that uses a series of perforated pipes (or equivalent) as an air distribution system running underneath a compost pile and connected to a blower that either draws or blows air through the piles. Little or no pile turning is performed.

AERATION (for composting): bringing about contact of air and composting solid organic matter, by means of turning or ventilating to allow microbial aerobic metabolism (biooxidation).

AEROBIC: occurring in the presence of oxygen./ANAEROBIC: occurring in the absence of oxygen.

BATCH COMPOSTING: all material is processed at the same time, without introducing new feedstock once composting has begun; windrow systems may be batch systems.

BIODEGRADABILITY: the potential that an organic component can be converted into simpler compounds by metabolic processes.

BULKING AGENT: material, usually carbonaceous such as sawdust, wood chips, or shredded yard trimmings added to a compost system to maintain airflow by preventing settling and compaction of waste.

COMPOSTABLE: organic material that can be biologically decomposed under aerobic conditions.

CONTAMINANT: unwanted material; physical contaminants of compost can include glass, plastic and stones; chemical contaminants can include trace heavy metals and toxic organic compounds; biological contaminants can include pathogens.

CURING: the last stage of composting that occurs after much of the readily metabolized material has been decomposed. Provides for additional stabilization, reduction of pathogens, and allows further decomposition of cellulose and lignin.

DECOMPOSITION: the breakdown of organic matter by microbial action.

DEWATERED SEWAGE SLUDGE: municipal sewage sludge with a total solids content of 12% by weight or greater that can be transported and handled as a semi-solid material.

FOREIGN MATTER: non-biodegradable matter contained in MSW compost such as glass, plastic, metals, etc. They are permitted only at low levels in market compost. (Soil and sand are non-degradable but can be very desirable components in some market composts.)

HEAVY METALS; TRACE METALS: trace elements whose concentrations are regulated because of the potential for toxicity to humans, animals, or plants, and includes chromium copper, nickel, cadmium, lead, mercury, and zinc if present in excessive amounts.

HUMUS: a complex amorphous aggregate, formed during the microbial decomposition or alteration of plant and animal residues and products synthesized by soil organisms; principal constituents are derivatives of lignins, proteins and cellulose combined with inorganic soil constituents.

INERTS: non-biodegradable products contained in compost (glass, plastics, etc.).

INORGANIC: substance in which carbon-to-carbon bonds are absent; mineral matter.

LEACHATE: liquid which has percolated through, or condensed out of mixed municipal solid wastes and extracted dissolved and suspended materials; liquid that drains from the mix of fresh organic matter.

MATURE COMPOST (synonym of COMPOST): the stabilized and sanitized product of composting. It has undergone decomposition and is in the process of humification (stabilization); it is characterized as containing readily available forms of plant nutrients, poor in phytotoxic acids and phenols, and low in readily available carbon compounds.

MIXED WASTE PROCESSING: central facility for inspecting and sorting commingled waste materials generally for the purpose of recovering materials of value for recycling.

MOISTURE CONTENT: weight of water in material divided by weight of solids in material.

ORGANIC CONTAMINANTS: synthetic trace organics including pesticides and other synthetic chemicals.

PATHOGEN: an organism or microorganism, including viruses, bacteria, fungi and protozoa capable of producing an infection or disease in a susceptible host.

PHYTOTOXIN: toxins which may endanger plant viability or functionality.

SOURCE SEPARATION: the practice, by primary waste generators such as households and businesses, of separating waste generated within the household or commercial operation into separate fractions, such as all newspapers together, all glass together, etc. and of placing them in separate containers for pickup by the waste hauler.

STABILITY: the degree to which the composted material can be stored or used without giving rise to nuisances or can be applied to the soil without causing problems.

STATIC PILE SYSTEM: similar to aerated static pile except that the air source may be controlled or may not be controlled.

TOXIN: compounds that cause a reduction of viability or functionality in living organisms.

VOLATILIZATION: gaseous loss of a substance to the atmosphere.

WINDROW SYSTEM: composting mixture is placed in elongated piles, called windrows. These windrows are aerated naturally by a chimney effect, by mechanically turning the piles with a machine such as a front-end loader or specially designed equipment, and/or by forced aeration.

YARD TRIMMINGS: grass clippings, leaves and weeds, and shrub and tree prunings six inches or less in diameter, from residences and businesses.

Resources

Disater Debris Management Planning
Basics-and-Benefits
BETO - Waste-to-Energy
Closing the Loop on Waste
Compost
Compost Brochure
Compost Fact #1
Composting at Home
DEC-Managing & Disposing HHS
Easy Composting
EPA-Recover Your Resources
EPA-Hazardous Waste Listing
EPA-RCRA Critcal Mission
EPA-Resource Conservation & Recovery Act
Home Composting
Natural Rendering
NYC Recycle Guide
NYS DEC Recycling Guide
Odd Recyclables
Quick-Start Guide to Compost
Recyclables Recovery Program
Recyclables Guideline - Modern
Reduce
Reuse
Solid Waste Management Facility
Solid Waste Management Policy Guide
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Sustainable Materials Management
NYS Recycles for Teachers
Waste to Energy
What is Hazardous Waste?

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