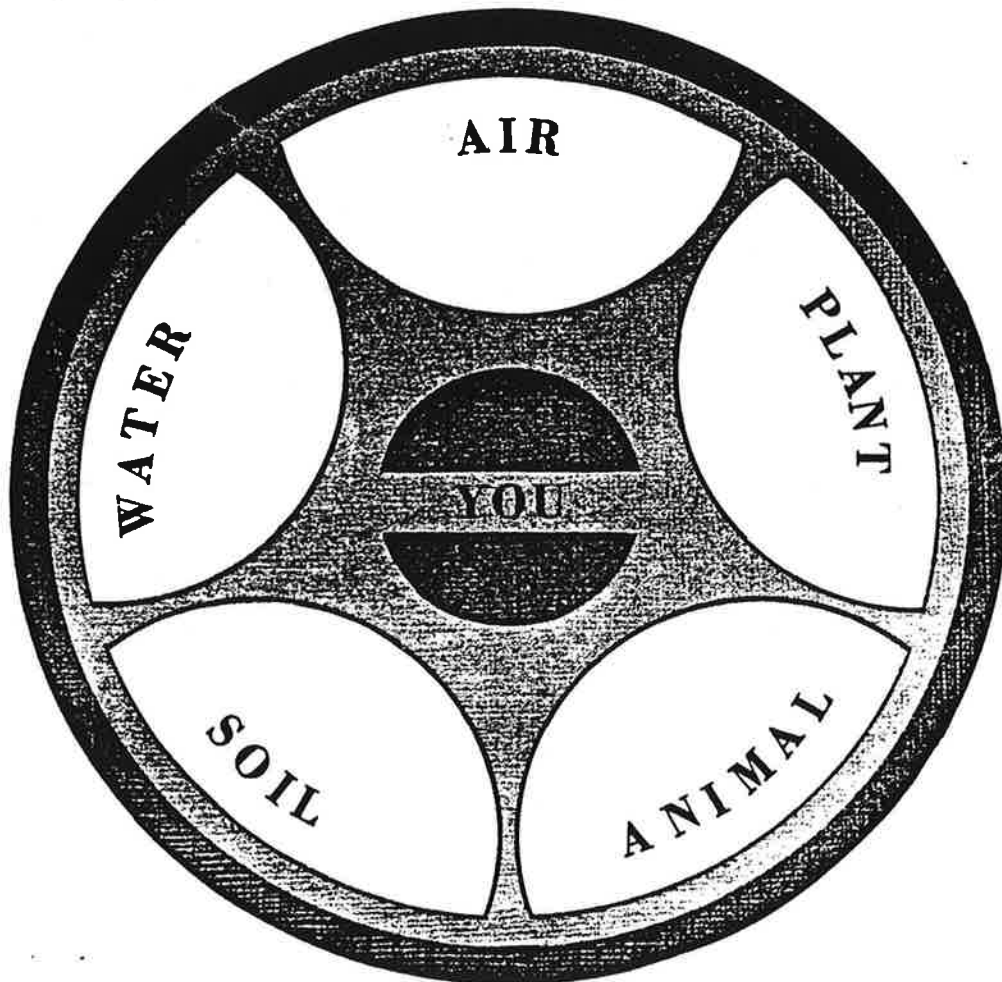


4-H Bulletin 330B

Extension Bulletin E-763
Resource Development Series

ECOSYSTEM ANALYSIS

"BASIC" ECOLOGY AND MANAGEMENT



MICHIGAN STATE UNIVERSITY
COOPERATIVE EXTENSION SERVICE
Resource Development and 4-H – Youth Programs

PREFACE

ECOSYSTEM ANALYSIS is an introductory approach to Basic Ecology and Management. It is an outgrowth of a need for Environmental Conservation (Extension) programs designed for high school age youth.

This Teacher's Guide is designed to help teachers and leaders teach basic environmental concepts and skills for on-the-site ecosystem analysis. It should be considered as a beginning, hopefully encouraging teachers as well as students, to get involved in problem-solving and decision-making concerns for today and tomorrow.

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ECOSYSTEM ANALYSIS

Environmental evaluation is becoming very important as we become more concerned about the quality of life on this great spaceship--EARTH. Our environment is defined as all that surrounds us. This includes living matter and non-living matter. It includes the good things we want in life as well as the bad things we don't want.

There have been many emotional statements on how long life, as we know it, will continue on this planet. Many of these have been based on scientific evidence. However, this scientific evidence has been used by different people to reach different conclusions. Regardless of the scientific evidence, one thing is certain to continue to exist--CHANGE. As change occurs we must be aware of it and be involved to influence any proposed man-made changes. We must be aware of present environmental conditions and how this change will affect the environment.

Evaluating the environment involves an on-the-spot analysis of the various factors which comprise the existing ecosystem. An ecosystem is a group of organisms--large and small--interacting with each other and their environment.

The process of ecosystem analysis includes: first, an overview of the total site; second, evaluation of the various components--water, air, soil, and biota (living matter); third, identifying the limiting factors to establish the use suitability indices of the site; and finally, an evaluation for the environmental quality. Given a situation with alternatives, decisions are then made as to the recommended use, the limitations, and suggested practices and/or corrective actions to maintain a quality environment.

SITE OVERVIEW

Any site--large or small--is a system of interacting processes involving biotic and abiotic components. How the site (system) is adjusting to its physical, chemical, and biological potential is of utmost importance.

The overview is a consideration of the site in its totality. It is important to identify the character of the site, the present use and function of the area, and signs of environmental quality.

A. CHARACTER OF THE SITE

The site character includes physical, biological, geographical, and political (land value, tax evaluation, land use) features. It involves consideration of the area surrounding the site as well as the site itself.

LOCATION	<input type="checkbox"/> Urban Area	<input type="checkbox"/> Rural Area
AFFECT BY POPULATION	<input type="checkbox"/> Yes	<input type="checkbox"/> No
STABILITY	<input type="checkbox"/> Stable	<input type="checkbox"/> Unstable
COMPLEXITY	<input type="checkbox"/> Simple	<input type="checkbox"/> Complex
PRODUCTIVITY	<input type="checkbox"/> Low	<input type="checkbox"/> High
LAND USE DEMANDS	<input type="checkbox"/> Heavy	<input type="checkbox"/> Light

LOCATION. This is an important factor because it relates to the pressure man will put on this ecosystem. Population density oftentimes affects the character of the site.

AFFECT BY POPULATION. This factor is directly related to the location. The nearness of people can have a great affect on the use of the area.

STABILITY. In evaluating this characteristic we must consider the stage of natural succession and the pressure of encroachment of man from the surrounding areas. Natural succession is a process of change which undergoes many stages. Some stages are more stable than others. Man's activities affect the process of natural succession and have a direct effect on site stability. Encroachment is the activity of man in and around the site as applied or applying to changing the site. This pressure of encroachment may be obvious such as the presence of growing residential areas or be hidden such as the use zoning or tax rate affecting the stability of the site.

COMPLEXITY. Here we consider the number of different types of life present. Many different species of plants and animals (including man) and their related life support systems indicate a very complex ecosystem while a simple ecosystem is represented by many individuals of a single species.

PRODUCTIVITY. This is a look at the ecological productivity of the site--the total amount of living matter (biomass) and the apparent quality and quantity of growth.

LAND USE DEMANDS. Consider the intensity of the use of the land--are many demands being made on the land--urbanization, industrialization, high-demand crops, row crops, grassland, forest, etc.?

B. PRESENT LAND USE

Present land use is man's major use of the land today. It may be used primarily for agriculture, natural resources, recreation, residential, or industry and commerce.

Present land use is directly related to the function of the site and has an influence on the various components, limiting factors, and the best site use rating.

AGRICULTURE	NATURAL RESOURCES	RECREATIONAL	RESIDENTIAL	INDUSTRIAL COMMERCIAL
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AGRICULTURE. Land being used predominantly for the production of food and/or fiber including cropland and pasture.

NATURAL RESOURCES. Land being used predominantly for maintaining, improving and developing natural resources; forests, wildlife habitat, marshland, ponds, streams, etc.

RECREATIONAL. Land being used primarily for recreation; picnic area, golf courses, playgrounds, campgrounds, parks, nature trails, etc.

RESIDENTIAL. Land being used for homes and the associated services; sewage disposal, water supply, power supply, streets, sidewalks, etc.

INDUSTRIAL AND COMMERCIAL. Land being used by industry and/or commerce and the associated development; parking lots, water sources, waste disposal, transportation and shipping routes, etc.

C. PRIMARY FUNCTION OF THE SITE

The primary function is the "prime" or major activity of the site. This activity results in products which help identify the primary function as productive, protective, multiple - use, or man-made.

THE PRIMARY FUNCTION - IDENTIFY

PRODUCTIVE	PROTECTIVE	MULTIPLE-USE	MAN-MADE
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PRODUCTIVE. Ecological productivity--plants and animals.

PROTECTIVE. Watershed, wilderness, etc.

MULTIPLE-USE. More than one use--lakes, streams, etc.

MAN-MADE. Developed by man to meet his needs.

THE PRODUCTS OF THE SITE - CHOOSE _____ ITEMS

--	--	--	--	--	--	--	--	--	--

- | | |
|-------------------------|---------------------------|
| 1. Food and Feed | 8. Esthetic value |
| 2. Wood and fiber | 9. Waste disposal |
| 3. Mining and drilling | 10. Transportation |
| 4. Wildlife cover | 11. Industrial production |
| 5. Erosion control | 12. Supply and services |
| 6. Watershed management | 13. Water supply |
| 7. Greenbelt zones | 14. Landfill |

D. SIGNS OF ENVIRONMENTAL QUALITY (EQ)

The following ten items can help in determining "overview signs" of EQ for the site. These visible characteristics are easily noticed and must be assessed to aid in the final evaluation.

Select the appropriate characteristic of each sign as an indicator of environmental improvement or degradation.

- | | | |
|--------------------------|---------------------|--------------------|
| 1. Soil erosion | ___ Not evident | ___ Evident |
| 2. Plant life | ___ Vigorous, dense | ___ Sickly, sparse |
| 3. Air pollution | ___ Not noticeable | ___ Noticeable |
| 4. Animals (Birdlife) | ___ Present | ___ Absent |
| 5. Water pollution | ___ Not visible | ___ Visible |
| 6. Storm sewers, ditches | ___ Adequate | ___ Overloaded |
| 7. Swamp areas | ___ Maintained | ___ Filled in |
| 8. Solid waste--litter | ___ Clean | ___ Problem |
| 9. People pressure | ___ Light--medium | ___ Heavy--crowded |
| 10. "Color of site" | ___ Green | ___ Brown-black |

SITE COMPONENTS

Each site - ECOSYSTEM - has a number of basic component parts --water, air, soil, and biota (plants and animals). An in-depth study of each component must be made to accurately assess the total site ecosystem. The results gathered in this section will be used in identifying the limiting factors, use suitability indices, and the suggested practices and/or corrective actions needed for maintaining environmental quality.

A. WATER COMPONENT OF THE SITE

Important considerations in the water component of the site are (1) type of surface water, (2) water temperature, (3) dissolved oxygen content, (4) turbidity of the water, (5) chemical nutrients--nitrogen and phosphorous, and (6) biochemical oxygen demand.

1. TYPE OF SURFACE WATER

In deciding the type of surface water, first recognize whether it is standing water or flowing water. Each of these categories has a number of types.

Standing Water:

Lake
 Pond
 Swamp
 Bog

Flowing Water:

River-Stream
 Spring
 Drainage Ditch
 Other _____

LAKE. A lake is defined as a body of water that is too deep to have rooted vegetation growing across its surface.

POND. A pond is usually smaller and shallower than a lake and is capable of supporting rooted vegetation all the way across its surface.

SWAMP. A swamp is usually classified as wet lowlands that will support trees and shrubs. There is surface water present at all times.

BOG. A bog is usually a mat of sphagnum moss that supports more grass than a swamp has. This mat will "vibrate" with each step and if thick enough, (6-8 in.) will support people, but water will seep through to cause wet feet.

RIVER-STREAM. It is very difficult to differentiate between these two types of flowing water. Generally they are characterized by eroded banks and wider stream beds than the other categories of flowing water.

SPRING. A spring is an underground stream coming to the surface.

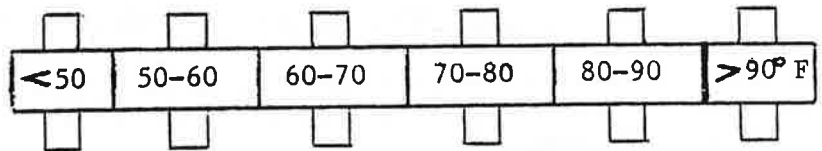
DRAINAGE DITCHES. Man-made ditches to drain surplus water.

2. TEMPERATURE OF WATER

The temperature of water has a great effect on the amount of life in the water. As temperature increases, the oxygen content decreases. However, as temperature increases, plant life is promoted, thereby requiring more oxygen to aid the decay of dead vegetation.

Temperature at surface

Temperature at bottom
(if deeper than 3')



The temperature of surface water can very easily be measured, whereas measuring the bottom temperature is more difficult. A sample can be made by dropping a container to the bottom, letting it fill, quickly pulling to the surface, and measuring the temperature. This procedure is not as accurate as other methods but is very reasonable and adequate. There are several instruments on the market that will give a more accurate reading.

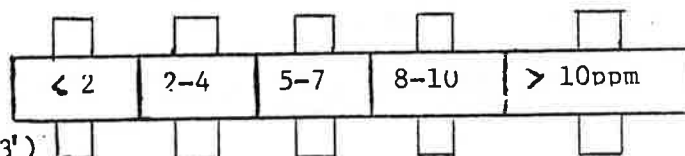
3. DISSOLVED OXYGEN

The Dissolved Oxygen (D.O.) content will affect the type and amount of life found in the water. The higher quality fish are found in waters with high D.O. levels. As the D.O. level decreases, many fish (other than rough fish) cannot survive. A high D.O. level is necessary in the early stages of their life cycle.

D.O. is directly related to water temperature. The colder water has a greater capacity to hold oxygen. Therefore, temperature and D.O. combine to affect the quality of life in water.

D.O. at surface

D.O. at bottom
(if deeper than 3')



D.O. is measured in parts per million (ppm).

A D.O. level less than 2ppm is considered extremely bad with few if any fish present.

D.O. levels of 2-4 ppm are bad with just the poorest quality fish living here.
 D.O. levels of 5-7 ppm are fair for fish life.
 D.O. levels of 8-10 ppm are considered good with many high quality fish present.
 A D.O. level over 10 ppm is considered extremely good for fish life, but is uncommon.

A suggested test procedure is in the appendix.

4. TURBIDITY OF WATER

This is a measurement of the cloudiness of water caused by humus, silt, organic debris, and other products suspended in the water. Turbidity affects the amount of light that can enter into the lower levels of the water thereby affecting the temperature and the dissolved oxygen level.

<25ppm very low	25-80 low	80-200 medium	200-400 high	> 400 ppm very high
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A certain amount of turbidity is desirable. Water will generally have a low productivity when turbidity is below 25 ppm, as well as when the turbidity is over 200 ppm.

The easiest method of testing turbidity is to prepare standards to which the samples in question can be compared. (One ppm is one milligram of soil per liter of water. Therefore, 25 mg soil in one liter of water will give a 25 ppm turbidity reading.)

5. CHEMICAL NUTRIENTS IN WATER

Just recently, we have become concerned about the level of nutrients in our water. The major nutrients--nitrogen and phosphorous--combine to cause excess algae and aquatic weed growth when they are present in high amounts. This resultant growth dies during the winter and settles to the bottom where decomposition begins. The aerobic process of decomposition requires oxygen, thereby interfering with fish life.

NITROGEN. This nutrient enters water through several means--surface runoff carrying fertilizer, effluent carrying human and/or animal wastes, ground water or seepages, and bacterial fixation. A certain quantity is essential in the life process of protein formation and is released through decomposition. At levels above 10 ppm, nitrate-nitrogen is dangerous to human infants as well as aquatic life.

VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
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Test _____ ppm

The test procedure is described in the appendix. The very low range is 0, low 1-3 ppm, medium 4-6 ppm, high 7-10 ppm and very high over 10 ppm. The optimum level for nitrate-nitrogen in water is under 7.0 ppm.

PHOSPHATES. This nutrient is often classified as the most serious pollutant to our bodies of water because of its affect on algae growth. It is normally used in very small quantities by plants, thereby giving a very low pollutant level. Phosphates enter the water through sewage and effluents, detergents, industrial wastes, and surface run-off carrying fertilizers.

LOW	MEDIUM	HIGH
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Given _____ ppm

Because of the various forms and types of phosphates, testing is extremely difficult. A suggested test procedure is in the appendix. In general, we classify the low range as under 0.5 ppm, medium 0.5-1.0 ppm, and high over 1.0 ppm. The optimum level for phosphates is under 1.0 ppm.

6. BIOCHEMICAL OXYGEN DEMAND

The Biochemical Oxygen Demand (B.O.D.) is the amount of oxygen needed to decompose dead and decaying organic matter and to meet the demand of living organisms. This measurement is compared with the dissolved oxygen (D.O.) test. If the B.O.D. test result is as great or nearly as great as the D.O., aquatic animals may not have enough oxygen to sustain life.

Very Clean	Clean	Fairly Clean	Doubtful	Bad
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Given _____ ppm

The test for B.O.D. takes five (5) days to complete. The results then are expressed in parts per million dissolved oxygen absorbed in five days. Very clean water has less than 1 ppm B.O.D., clean 1-2 ppm, fairly clean 3-4 ppm, doubtful 5-10 ppm and bad over 10 ppm. A suggested test procedure is in the appendix.

B. AIR COMPONENT OF THE SITE

Clear air is as important as clean water. Although we cannot see clean air, we cannot live without it. The average person breathes 35 pounds of air each day, which is more than the food we eat and the water we drink combined.

Air pollution may be defined as contamination of the air by waste products of man's activities. This pollution limits visibility, may be injurious to life, and certainly interferes with the enjoyment of life.

There are many types of aerial garbage (pollutants): carbon monoxide--the odorless, tasteless, poisonous gas that depletes the oxygen content of our blood, causing death. Sulfur dioxide--the gases given off during coal and oil burning, causing metals to rust, limited visibility, irritations of the eyes, nose, throat, and possibly the lungs. Nitrogen oxides--these status-symbol pollutants (so called because they only occur in highly advanced countries) are yellowish-brown in color and have a pungent, sweetish odor, which is detectable at 1 to 3 parts per million. Hydrocarbons--these unburned chemicals are, generally, dangerous only in very high concentrations. However, they may react in the atmosphere to form smog.

1. VISIBILITY

Visibility is defined as the distance one can see. High visibility would allow us to see to the horizon. However, as stated above, this visibility may be limited by pollution. As we evaluate the environment we must know what is causing the reduced visibility.

Time of Day: _____

Clear	Haze	Fog	Smog
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CLEAR. Unlimited visibility.

HAZE. A slightly limited visibility caused by "particulate matter" under dry weather conditions.

FOG. A limited visibility caused by the condensation of water vapor in the air.

SMOG. A mixture of smoke and fog. The limited visibility resulting from the sun's effect on certain pollutants in the air, notably those from automobile exhaust --the chemical changes brought about by the radiant energy of the sun acting upon various polluting substances. The products are known as "photochemical smog".

2. PARTICULATE MATTER

Particulate matter may be solid or liquid droplets. These particles may settle out of the air to soil clothing and dirty window sills or may stay suspended to cause irritations to the respiratory system or do other damage. The density of particulate matter is very important in evaluating air quality.

Check all three locations:

	Very Low	Low	Moderate	High	Very High
Location 1	_____	_____	_____	_____	_____
Location 2	_____	_____	_____	_____	_____
Location 3	_____	_____	_____	_____	_____

VERY LOW. No particulate matter present; "Clear"

LOW. Less than 20% density; "Hazy"

MODERATE. 20-40% density; "Grayish"--particulate matter definitely present

HIGH. 40-60% density; "Dark"

VERY HIGH. Over 60% density; "Very dark"

NOTE: The Ringelmann Smoke Chart can be helpful in determining the particulate matter density. The MSU version of this chart is in the appendix.

Ringelmann Smoke Chart*

A series of charts indicating the density of smoke and fumes. The charts, numbered 0 to 5, simulate various densities by presenting different percentages of black.

- Chart 0 - has no black
- Chart 1 - equivalent to 20% black
- Chart 2 - equivalent to 40% black
- Chart 3 - equivalent to 60% black
- Chart 4 - equivalent to 80% black
- Chart 5 - equivalent to 100% black

*Circular 8333 U. S. Department of Interior, Bureau of Mines

3. PARTICULATE SIZE

Particulates are described by type and size. Particulate size is of special significance in determining air pollution. The unit used to describe particulate size is the micron. A micron is equal to 1/1,000 of a millimeter or 1/25,000 of an inch. We can see particles over 10 microns in diameter with the naked eye. Raindrops are 400 to 5,000 microns and fog droplets are 5 to 60 microns in size.

Check all three locations:

A Visible as individual particles	B Visible as a group of particles	C Visible only when extremely dense; detect by odor
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Location 1	_____	_____	_____
Location 2	_____	_____	_____
Location 3	_____	_____	_____

GROUP A. Large particles (over 10 microns) that settle out of the air near the source including soil, coarse dust, large fly ash, pollen, etc.

GROUP B. Small particles (1.0-10.0 microns) that may travel some distance in air currents to be troublesome for some distance from the source. This group includes dust and fine fly ash.

GROUP C. Minute particles (under 1.0 microns) that travel great distances and present problems over large areas including fumes, smoke, and aerosols.

4. PARTICULATE TYPE

The type of particulate matter must be identified in order to locate the source of pollution. The larger particles are easily detected and the source is nearby. Although these particles do not travel great distances, this type of pollution is of great concern in the immediate vicinity.

Soil	Fly Ash	Pollen	Other
------	---------	--------	-------

Location 1	_____	_____	_____	_____
Location 2	_____	_____	_____	_____
Location 3	_____	_____	_____	_____

SOIL. The mineral and/or organic particles of soil.

FLY ASH. Impurities remaining after burning coal and other materials.

POLLEN. Yellowed colored powder from the stamen of flowers. It is a great concern of people with allergies, but otherwise not harmful. Pollen size may range from very small (1 micron) to extremely large (over 20 microns).

5. NOTICABLE EFFECTS ON PLANTS

Many plants are extremely sensitive to air pollution. They are readily available for observation as they show effects more rapidly than animals. Many times shrubs are used to monitor air pollution and as an aid in reducing air pollution as well as for ornamental values.

None	Slight	Moderate	Severe

NONE. Healthy plants with no visible abnormality.

SLIGHT. Few abnormal spots on plants or few plants affected.

MODERATE. More plants or more of the plant damaged.

SEVERE. Reduced stands, deformed plants, stunted plants, and so on.

It is important to not confuse abnormalities due to nutrient deficiencies with abnormalities due to air pollution.

C. SOIL COMPONENT OF THE SITE

The soil is extremely important in overall environmental quality since it serves as the base for all life. It is the filter, storage, and reduction center for organic materials - solids, liquids, and gases - basic to sustaining life. It is the home for many micro-organisms, which are fundamental in decomposition and growth activities.

Most of our food comes either directly from the soil as cereals, fruits and vegetables or indirectly through animals (meat, milk, and eggs) as they consume grass and other feed crops. Soil--land use--is the foundation for man's activities.

As we evaluate the soil component, we must consider the location, slope, texture, color, water table depth, erosion, and permeability. Each factor is important in understanding this component.

1. POSITION

The position of our site has great effects on its usage. A floodplain site does not lend itself well to subdividing because of the occurrence of seasonal floods but may lend itself very well to vegetable farming where the growing season is short and the need for irrigation is high.



FLOODPLAIN. The lowland area adjacent to a river or stream. This area will experience flooding from time to time.

TERRACE. The area near a river or stream but high enough above the waterbed to avoid flooding on a seasonal basis.

UPLAND. The area away from rivers and streams and not subject to flooding.

2. SLOPE

The slope or lay of the land is important because it affects the amount of erosion and water runoff. The steepness also affects the speed of water runoff and the ease of cultivation. As the steepness increases, the uses of the land become more limited. Slope is expressed in percent which represents the number of feet of rise or fall in a 100 foot distance.

0-2%	2-6%	6-12%	12-18%	over 18%
Nearly Level	Gently Sloping	Moderately Sloping	Strongly Sloping	Steep

NEARLY LEVEL. Has no limitation on its use. Any limitations are a result of other factors.

GENTLY SLOPING. Has some erosion and must have erosion control practices applied to stabilize the site.

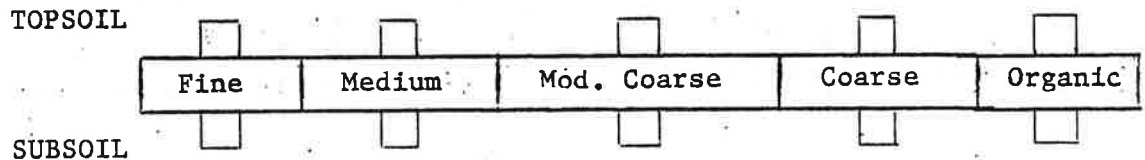
MODERATELY SLOPING. Has a greater erosion problem and must be used very carefully to avoid losing soil.

STRONGLY SLOPING. Has severe limitations and should be maintained with permanent vegetation such as grass or trees. Using this land as building sites would require careful planning to avoid a great loss of soil.

STEEP. Should be maintained in permanent vegetation, preferably trees. This land is too steep for any other use if the environment is to be maintained.

3. TEXTURE

Soil texture has a very important effect on moisture holding capacity, permeability, fertility, and erosion. Texture refers to the percentage of sand, silt, and clay. These three soil particles have distinct characteristics which allow us to determine the soil texture by rubbing a sample between our thumb and fore-finger. Sand is gritty, silt is smooth and floury, and clay is sticky when moist.



FINE-TEXTURED SOILS include clay, clay loam, silty clay loam and sandy clay loam textural classes. They are made up mostly of clay and silt but sandy clay loam contains a noticeable amount of sand. They are sticky and plastic when moist and can be formed readily into a ribbon when pressed between the thumb and fore-finger. Clay has over 40 percent clay particles, clay loam and silty clay loam have between 27 and 40 percent clay particles, while sandy clay loam has between 20 and 35 percent clay and over 45 percent sand.

MEDIUM-TEXTURED SOILS include silt loam and loam textural classes. Silt loam has more than 50 percent silt particles. Loam consists of about equal parts of sand, silt and clay particles.

MODERATELY COARSE TEXTURED SOILS include sandy loam and loamy sand textural classes. They are made of mostly different sized sand particles with less than 20 percent of clay particles present. These soils are difficult to mold when moist.

COARSE-TEXTURED SOILS include coarse and medium sands with some gravel. They contain 85 percent sand particles with a harsh, gritty feel even when moist. They will not form a stable mold when moist.

ORGANIC SOILS are mucks and peats. They are made up largely of woody and fibrous materials.

4. COLOR

Soil color is a very noticeable characteristic. The true color is easier to determine when the soil is moist rather than when soil is dry. Color indicates the organic matter content in topsoil and the natural drainage effects in subsoil.

TOPSOIL

Dark Brown to Black 5.0% O.M.	Brown 2.5-5.0% O.M.	Light Brown and Tan 2.5% O.M.
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DARK BROWN. Very dark brown or black colors indicate a high organic matter content. The darkest colored surface layers have the highest organic matter content and were usually developed under naturally very poorly drained conditions.

BROWN. Grayish brown or dark grayish brown colors indicate a moderate amount of organic matter present. Most well and imperfectly drained soils having fine and medium textures are in this color group.

LIGHT BROWN. Light gray, pale yellow, or pale brown colors indicate soils that are low in organic matter. Most of the well-drained soils are in this color group.

SUBSOIL

Dull	Mottled	Bright
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DULL. Mainly gray colors usually with rust-brown and orange streaks and spots. These dull colors indicate that the soil developed under naturally, poorly drained conditions with the water table at or near the surface of the ground during part of the year. Artificial drainage is necessary on these soils.

MOTTLED. Mixed yellow and brown colors with some grays with many rust-brown and orange streaks and spots. This color pattern indicates the soil was developed under imperfectly drained conditions. Artificial drainage is usually needed on these soils.

BRIGHT. Reds, yellows, and brown are the principal colors. These bright solid colors indicate a soil which was formed under good natural drainage conditions.

5. DEPTH

When we consider the depth of a soil, we are concerned about the water table or impervious layers. The water table or the impervious layer (layer that water can't penetrate) can have a considerable affect on the use of the site. A shallow soil (high water table or impervious layer) may make the site unsuited for building, whereas a deep soil (low water table) may make the site ideal for many uses.

Depth to Water Table or Impervious Layer (i.e. marl or bedrock):

< 10"	10-20"	20-40"	40-72"	> 72"
Very Shallow	Shallow	Mod. Deep	Deep	Very Deep

6. EROSION

Erosion is the gradual process of losing soil. It is most evident when rills and gullies are formed. However, much soil is lost before this without detection. This latter type, known as sheet erosion, is more dangerous than the former type--gully erosion. Erosion occurs as a result of wind or water action on exposed soil.

Slight	Moderate	Severe	Very Severe

Erosion is rather difficult to recognize and classify. Attention must be given to the amount of subsoil in the surface layer.

SLIGHT. All, or nearly all, the original surface soil is present.

MODERATE. A mixture of original surface soil and subsoil.

SEVERE. Mainly subsoil. Gullies or wind blow-outs may be present.

VERY SEVERE. Severely gullied or deep wind blow-outs.

7. PERMEABILITY

Permeability is the rate at which water enters and moves through the soil. This is very important in its effect on drainage and run-off. Permeability is measured in inches per hour.

Very Slow <.05"/hr.	Slow .05-0.8"/hr.	Moderate 0.8-2.5"/hr.	Rapid 2.5-5.0"/hr.	Very Rapid >5.0"/hr.
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See the permeability-percolation test procedure in the appendix.

D. BIOTA COMPONENT OF THE SITE

The biota component is the living portion of the site. This living portion involves plants and animals from trees and large animals to microscopic plants (fungi, etc.) and animals (protozoan, etc.) These living organisms may live below the surface as well as above, in water as well as soil, and may be producers or decomposers as well as consumers.

1. SOIL ORGANISMS

The soil is the home of innumerable kinds of plant and animal life ranging in size from those too small to be seen with a powerful microscope to large ones such as earthworms. Most of the soil organisms are so small you will not be able to see them without a microscope.

These organisms have a great effect on the characteristics of the soil. At the same time, such soil characteristics as soil structure, air movement, water movement, organic matter content, acidity, and management, all strongly affect the number of organisms in the soil.

Plant life that is too small to be seen without a microscope includes bacteria, fungi, and algae. Bacteria (one-celled organisms) may have a population of one (1) to four (4) billion per gram of soil. Fungi, which include molds, do not contain chlorophyll and therefore, cannot manufacture their own food. A gram of soil may contain 8,000 to one (1) million of these. Soil algae are microscopic plants that contain chlorophyll and may have as many as 100,000 present per gram of soil under favorable conditions.

Animal life in the soil includes protozoa, microscopic animals larger than bacteria; nematodes, larger and more complicated than protozoa but some still too small to be seen without a microscope; and earthworms, ants, snails, spiders, mites, and various worms and insects.

The animal life may be classified as follows:

WORMS--animals without legs such as night crawlers and earthworms.

GRUBS--worm-like animals with legs.

SNAILS--animals with spiral shaped shells; snails without shells are called slugs.

INSECTS--animals with three pairs of legs; may have hard shells or soft bodies and may be winged or wingless.

SPIDERS, MITES AND TICKS--animals with four pairs of legs.

ANIMALS with more than four pairs of legs.

OTHER --animals not classified into the above groups.

2. AQUATIC ORGANISMS

The aquatic organisms are all the plant and animal life in water (i.e. pond or stream). They include the fish--large and small--as well as the submerged plants and the microscopic organisms in the aquatic community. By various sampling methods (see appendix) we can identify the major aquatic organisms of the site.

3. DOMINANT PLANTS

The dominant plants that are present can tell us much about the natural succession of the site as well as the present use. These plants are classified as follows:

WEEDS (including aquatic plants)
Annual or Perennial

GRASSES AND SEDGES

SHRUBS

TREES UNDER 30 FEET
Deciduous or Coniferous

TREES OVER 30 FEET
Deciduous or Coniferous

4. DOMINANT ANIMALS

The dominant animals present also tell us much about natural succession. As we consider this factor we must not always expect to see the animals, but instead, should look for evidence of their presence (i.e. droppings, tracks, burrows and nests, etc.). Animals may be classified as follows:

MAMMALS
Small--mice, squirrels, rabbits, etc.
Large--possum, porcupine, muskrat,
Very Large--deer, elk, bear, etc.

BIRDS
Song Birds--robins
Game Birds--pheasant, quail, etc.
Waterfowl--ducks, geese, etc.
Other--owls, hawks, etc.

AMPHIBIANS AND REPTILES
Frogs, toads, snakes, etc.

FISH (Consider only when the site is predominantly water.)

5. FOOD WEB (P-C-D RELATIONSHIP)

When considering the food web we are concerned about the relationship of producer, consumer, and decomposer organisms as they function to maintain

the quality environment. Producer organisms are those which use sunlight to produce food for the community (i.e. green plants). Consumer organisms are those that depend on the producers for their survival. Consumers may be herbivorous--feed on plants--or carnivorous--feed on other animals. Decomposer organisms feed on dead plants and animals to break them down into their constituent substances and release these substances (water, nitrogen, carbon dioxide, etc.) for use by the producers. The decomposers make the cycle complete so that each of the three groups depend on the others for their food.