WETLAND MONITORING MANUAL

What is a Wetland?

Wetlands cover a relatively small portion of the earth's land surface, only about six percent, but their ecological importance far exceeds their size. Wetlands can be defined rather simply as areas--part land, part water--in which water is the controlling factor in the environment. Several more complex definitions of wetlands have been developed by the federal government in conjunction with various laws, regulations, and programs, and, these are lengthy and controversial. In general, however, wetlands exhibit the following characteristics:

1. The water table (the upper limit of that portion of the ground that is entirely saturated with water) remains at or near the surface, and water covers the land at least part of the year.
2. Wetlands soils are hydric (wet for most of the year and low in oxygen).
3. Wetlands support plants that can tolerate life in water or saturated soil (hydrophytes). Plant material accumulates rapidly in wetlands and decays very slowly. In short, wetlands occupy areas between terrestrial (land) and aquatic (water) habitats and have developed ecosystems that are uniquely their own.

Wetlands can be classified into a variety of forms, each with its own special profile: swamps, marshes, bogs, seeps, and fens, to list only the most familiar. Illinois alone has many different wetland habitats that vary in climate, water supply, soil type, and plant and animal residents. Throughout the Midwest, wetlands range from those where the soil is saturated for at least part of the year to those with permanently standing water, from wetlands associated with the seasonal changes that occur along a river to those that were formed directly or indirectly by the action of ancient glaciers, from wetlands characterized by organic soils (soils made primarily from decayed plants) to those where inorganic (mineral) soils predominate, and from grassy wetlands to those that are forested. In short, no two wetlands are alike but each is an important ecosystem with influence far beyond its perimeters.

In much of the Midwest, wetlands were formed either by the action of glaciers or by rivers. Those created by glaciers vary from the open water of glacial lakes to those found on relatively dry land. During the last Ice Age (the Wisconsinan Glacier that retreated some 12,000-7,000 years ago), great chunks of ice broke off from the main body of the glacier and were left behind to melt and form lakes. In other areas, however, glaciers merely scooped out shallow depressions that allowed water to accumulate as the ice retreated. Wetlands formed by rivers are of several types, including oxbow marshes, floodplain bottomlands, and backwater lakes. When a meandering river changes course and leaves a portion of its channel isolated except when the river floods, an oxbow pond is formed. In time, this pond fills in and becomes an oxbow marsh. Floodplain bottomlands are created by periodic flooding and include bottomland forest, swamp, and marsh habitats. Backwater (bottomland) lakes form when soil and sand settle out of river currents and form long islands in the river. If such an island becomes high enough to completely separate the side channel from the main river, a bottomland lake is formed. In addition, human activities create as well as destroy wetlands. Many wetlands are produced by impoundments, excavations, and the construction of dikes.

The plants and animals found in oxbow marshes and backwater lakes are largely determined by how frequently these areas are flooded by the main river. Because this annual flood is a predictable and reoccurring phenomenon, many organisms have evolved adaptations that enable them to exploit the seasonally expanded habitat and the food brought in by the flood. Times of low water, however, are just as important as flooding. A low water level concentrates fish into shallow pools where herons and

egrets obtain food for nestlings; it exposes mudflats where moist-soil plants grow and produce seeds sought by waterfowl; it allows soils to drain and be exposed to oxygen, thereby speeding the processes of decay and the recycling of nutrients.

To a lesser extent, beavers play a role in the formation of Midwestern wetlands. When a beaver dams a stream, water accumulates behind the dam and a pond or small lake forms. When the beaver abandons the site, usually because local food sources have run out, the dam eventually begins to leak and a wetland of sorts forms upstream. Wetland plants and animals persist in the area as long as the soil remains saturated.

Midwestern wetlands can have either mineral (inorganic) or organic soils. Mineral soils are composed largely of sand, silt or clay. Organic soils, generally called peat or muck, are formed from plant material that has partially decayed under wet conditions low in oxygen (anaerobic). These soils are low in oxygen because standing water has partially insulated the plant material from the atmosphere. Organic soils are better able than inorganic soils to take up (absorb) chemicals from the environment, an important attribute that will be discussed later in more detail.

Hydrology, or the way water is distributed on or below the earth's surface, is important in classifying wetlands in the Midwest. In general, wetlands have two sources of water: surface water from precipitation (rain, snow, ice) and ground water (the water found below the surface of the soil). A depression that is deep enough to extend below the water table forms a wetland fed by both ground and surface water. A depression that does not extend below the water table receives only surface water such as precipitation and runoff from the surrounding land. Wetlands found on slopes, usually surrounding a lake, pond, or stream, may receive water from several sources, including runoff and floodwater. The length of time the area remains saturated is dependent on the degree of slope, soil characteristics, and the frequency of flooding or runoff from precipitation. Knowing where a wetland receives its water (its hydrology) is crucial in protecting and managing that area.

GETTING STARTED

Site Selection

Things to note.

- Wetlands must have dimensions equivalent to 2500 m^2 (e.g. 50 m x 50 m—2500 m^2 is equal to .25 hectare or 2/3 acre).
- Do not choose sites that have only a narrow margin of vegetation around a large area of open water. Sites should have a minimum of 20 m of emergent vegetation before open water is encountered. Artificially constructed wetlands are suitable.
- If the water is too deep to safely wade or has other hazardous factors such as a deep mucky bottom, then the site is unsuitable for monitoring. If you have any doubts about hazards, reject the site and find another.
- Riverine habitats (habitats along streams) with emergent vegetation are not included.
- Wetlands must have < 50 % woody shrub or tree cover.

Equipment You Will Need

The following equipment is needed to **establish your site.**

- *Wetland Monitoring Manual*
- two 51-m ropes marked at 5- and 10-m intervals

- meter stick
- 7 metal tent stakes (includes 2 extras)
- 7 aluminum tags, pre-labeled (includes 2 extras)
- 1 hammer or mallet
- 2 compasses
- topographic map, directions, and/or site sketch (if available)
- local road map
- global positioning unit (GPS unit) – optional
- pencils
- Site Sketch Form
- Site Characterization Data Sheet
- Site Establishment Data Sheet
- Surrounding Land Use Sheet

The following equipment is needed to **monitor your site.**

- meter stick
- 4 tent stakes (for baseline)
- two 51-m ropes (for baseline and transect)
- 50-m tape measure
- 2 pvc or wood ¼ m^2 sampling quadrats
- 4 alumunim tent stakes
- vegetation assessment column (VAC) for Remote Sensing
- 6-8 foot step ladder for Remote Sensing
- plywood strips on which to position ladder for Remote Sensing

Prepare equipment before going into the field.

Transect ropes must be marked with black tape or permanent black marker in 5-m intervals from 0 to 50 m. Be sure to leave ½ m extra at each end for tying the ropes to the stakes.

The **aluminum tags** used to mark each transect stake should be labeled before you go into the field. On each tag, etch the township name, township and range numbers, "baseline" or "transect," and "beginning" or "end." Four tags are needed, two for the baseline and two for the transect.

The **quadrat** used to mark the plot for measuring ground vegetation can be made of either ½-inch PVC or 1- to 1 and ½-inch wood, about the thickness of a meter stick. The PVC piping can be connected using four 90° elbow connectors, and the wooden frame sides can be connected using wing nuts. In either case, it is important to be able to remove at least one side of the frame so that the frame can be placed around a tree trunk. The internal dimension of the quadrat must be exactly ½ meter by ½ meter. For PVC piping, cut the sides to exactly 50 cm (a hand saw will do the job). If using wood, it is a good idea to paint the quadrats a bright color to make them more visible. (See Figure 1).

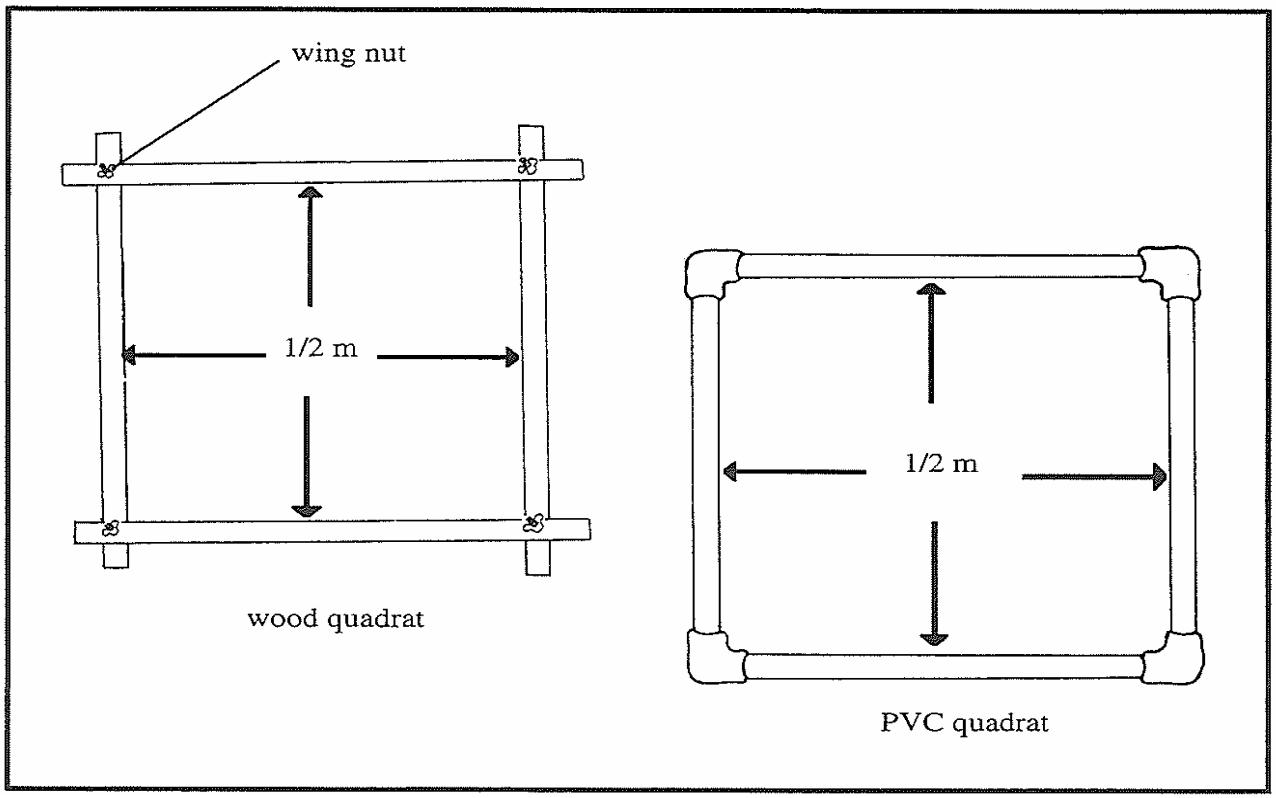


Figure 1: Quadrat construction.

The **VAC** is used to estimate the percent cover of different types of aquatic vegetation and open water in the wetland. To construct a VAC, make a copy of the VAC pattern found in Appendix B on clear overhead transparency film. This will give you both a 10% VAC and a 20% VAC. Carefully cut out each transparency, leaving at least 15 mm of film around the pattern.

Transfer the shape of the VAC onto the center of a 15 cm x 18 cm or larger rigid board such as cardboard, foamboard, wood or plastic. (Hint: a good way to transfer the shape of the VAC to the board is to make a paper photocopy of the pattern. Lay it over the board and punch a small hole at each corner of the VAC. Then draw a line between each of the holes using a pencil.) Then carefully cut out and remove the VAC shape from the center.

Carefully glue the transparency over the opening on the board, being careful to line up the edges with the opening.

Make both the 10% VAC and the 20% VAC and label the board so they can easily be distinguished.

Things to Bring:

insect repellent
water bottle
rain gear
first aid kit

Appropriate Dress: hip boots (never open-toed shoes), long pants, long-sleeved shirt, long socks, hat with brim

Safety

General Precautions:
Always tuck in your shirt. When possible, tuck your pants into your socks to avoid ticks. Wearing light-colored clothing can help to locate ticks. Also, many insects, including mosquitoes, are attracted to dark colors, particularly red and black. Use insect repellent to help keep mosquitoes and other insects from biting you. Repellents with the compound DEET should only be used on clothing, never directly applied to the skin. Do not allow any repellent to come in contact with plastics, like watches or contact lenses.

Be careful of steep or variable terrain, or various objects that may be dangerous, such as fallen trees, holes, or human artifacts (old fences, broken glass, etc.). If you do not feel comfortable at a site, find another site that is more suitable for monitoring.

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

Before you go monitoring, check with the landowner to make sure that hunters will not be using the land at the time when you plan to monitor. It is also a good idea to wear bright colors (orange or yellow—avoid white).

Animals:
All ticks should be removed if found, whether attached or not. There are several types of ticks in Illinois, but the deer tick is the most common carrier of diseases. Know what a deer tick looks like. Always check your clothing after being outside. Also, closely check your skin for ticks.

The wetlands of Illinois contain other animals that may be harmful to humans, including mosquitoes, biting flies, bees, and wasps. Though rare, some animals that may not appear dangerous can carry rabies. Know where people can receive prompt medical care. It is best to observe animals, not touch.

Plants:
Poison ivy is found throughout the state and grows in many forms. It can be a small erect ground-layer plant, shrub, climbing vine, or trailing vine. Vines tend to appear hairy, but not always. Poison ivy has three leaflets, with the center leaflet having a long stalk and the two side leaflets having very short stalks. All parts of the plant contain the oil that causes a reaction. The reaction is generally swelling, blistering, and itchiness of the infected area. People vary in their reaction but direct contact with the plant should be avoided. If exposed, promptly (within 1-2 hours) clean the area with rubbing alcohol. The oil from poison ivy can remain active for weeks on clothing; launder all field clothes after contact.

Stinging nettle (genus *Urtica*) usually grows in moist areas, such as bottomland forests. It grows erect up to four feet and is covered with small, stiff, stinging hairs which can irritate the skin on contact. Leaves are heart-shaped, with a long stalk and large teeth.

Parsnip and cow parsnip contain toxins that are photoactive. These compounds can cause blistering if you get them on your skin and then expose the area to sunlight. Wear long pants and long-sleeved shirts.

Wetland Etiquette

Wetland ecosystems are important for many reasons. They are home to literally hundreds of species of plants and thousands of species of other organisms. Therefore, it is important that we minimize the amount of damage we may inflict upon them when monitoring.

The procedures, from the establishment of transect lines to the order in which the procedures are conducted, have been designed to minimize the impact on the wetland. All procedures should be followed exactly to make sure as little damage as possible occurs. These procedures will help protect the wetland from degradation and also ensure that long-term trends in habitat quality are not affected by the data collection process itself. (Avoid the temptation to remove "undesirable" non-native vegetation when monitoring, unless this is part of a management plan.)

Trampling occurs anytime a person walks through a wetland. By keeping your group size small (no more than 10), reducing the number of times the transect is walked, and being considerate of the wetland as a living system, trampling and other adverse effects can be minimized.

Monitoring Tips

DO

carry a first-aid kit.
make sure the landowner knows when you are in the wetland. Let others know where you will be and when you plan to return.
stay near the transect. Minimize trampling of vegetation.
follow the monitoring procedures exactly.
look out for potential dangers and avoid them.
try to be quiet. The wetland is home to many animals that are frightened by humans, particularly by loud noises.
be polite to anyone you encounter and explain what you are doing.
wear appropriate clothing.
keep group size small, no more than 10 people.

DON'T

intentionally damage vegetation, other than for small leaf samples.
work alone.
travel back and forth along the transect needlessly.
develop your own procedures that you believe are easier or more appropriate.
touch any plant believed to be poisonous.
touch any animal – some may be dangerous.
pester animals.
work during dangerous weather conditions.
go near waterways during rain.
leave anything behind other than the few stakes used to mark your site.

SITE CHARACTERIZATION AND ESTABLISHMENT

Important: Before you do any work on the site, you must determine who owns the land and gain permission to visit the site.

Task:
To characterize a wetland monitoring site based on its geography, land cover and management, and surrounding habitat, and then establish the site prior to monitoring.

Materials:

- *Wetland Monitoring Manual*
- two 51-m ropes marked at 5- and 10-m intervals
- meter stick
- 7 metal tent stakes (includes 2 extras)
- 7 aluminum tags, pre-labeled (includes 2 extras)
- hammer or mallet
- 2 compasses
- topographic map, directions, and/or site sketch (if available)
- local road map
- global positioning unit (GPS unit) – optional
- pencils
- Wetland Site Identification Form
- Site Sketch Sheet
- Surrounding Land Use Sheet
- Site Characterization/Establishment Sheet

Procedure – Site Characterization

1. <u>Check with the land owner or manager regarding past and present use of the site.</u>

Prior to monitoring, contact the land owner or manager with your monitoring plans. Take the opportunity to ask about the past use and management of the land. Ask whether the land has been used for grazing, cultivation, or other uses, and whether the land is being used for any of these uses at present. Note this information on the "Signs of Human Use" portion of the Site Characterization/Establishment sheet, along with any additional signs of human uses that you observe while monitoring.

2. <u>Determine the number of steps per 50 meters.</u>

Also prior to monitoring, determine the number of steps it takes to walk a distance of 50 m. Find an open, flat area away from the site, lay out a 51-m rope, then stake the rope down at 0 and 50 m. Now walk the length of the rope, and count how many steps it takes to cover 50 m. Walk in a normal manner, trying not to extend your stride. Do this two times and take the average.

3. <u>Observe the wetland site for signs of human uses.</u>

Carefully look for signs of previous or current human uses of the wetland. Record these observations on the Site Characterization/Establishment sheet.

4. Estimate the size of the wetland.

Draw a small outline of the shape of the wetland on the Site Sketch Sheet. If the wetland has a rectangular shape, estimate its size in m^2 by pacing it off (if the site is not too large). Count the number of steps needed to walk along each of two adjoining sides. Record the number of steps for each side on the data sheet. Later, convert the step count to m and record. Then multiply the length of the two sides to get the area in m^2 and record again (on Site Characterization/Establishment sheet).

For odd-shaped sites that have straight sides but do not form a rectangle (e.g., L-shaped or U-shaped sites), divide the site into a series of smaller rectangles, and follow the above procedure to estimate the size of each rectangle. Then add these together and record. Be sure to report the length of the adjoining sides, and also the area in m^2, of each individual rectangle. (See Figure 2).

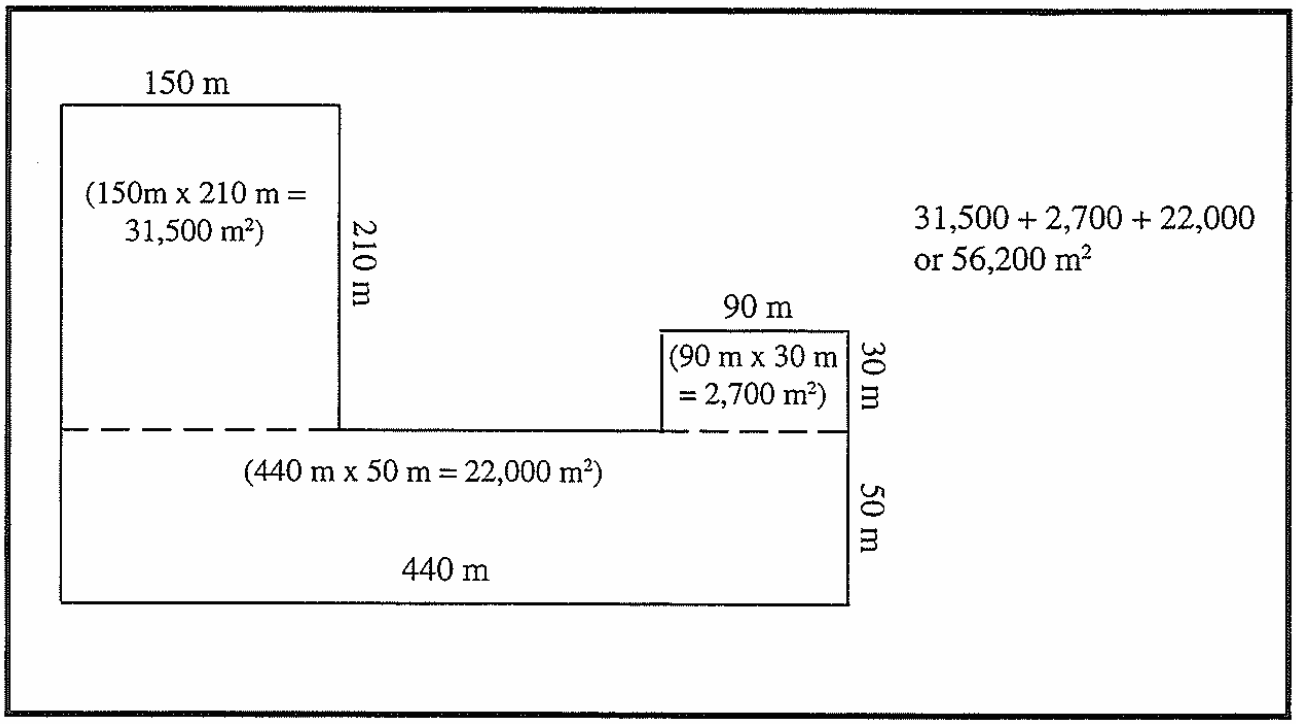


Figure 2. To estimate the area of an odd-shaped site that has straight sides, divide the site into a series of small rectangles and determine the area of each.

For more or less circular sites, measure the diameter by pacing it off outside of the wetland. This procedure is done by finding a spot outside the wetland where you can stand and establish an imaginary 90-degree angle between two sides of the wetland. Once in this position, record the compass bearing toward either side of the 90-degree angle, and begin walking in the direction of the other side of the angle, pacing off the distance as you go. Walk until you are lined up with the far side of the wetland on the same bearing recorded at the start of the walk (see Figure 3). Record the diameter in m on the data sheet. Then calculate the area of the wetland in m^2 by using the following formula:

Area of a Circle = πr^2, where $\pi = 3.14$, r = radius = ½ diameter

Record the area on the data sheet.

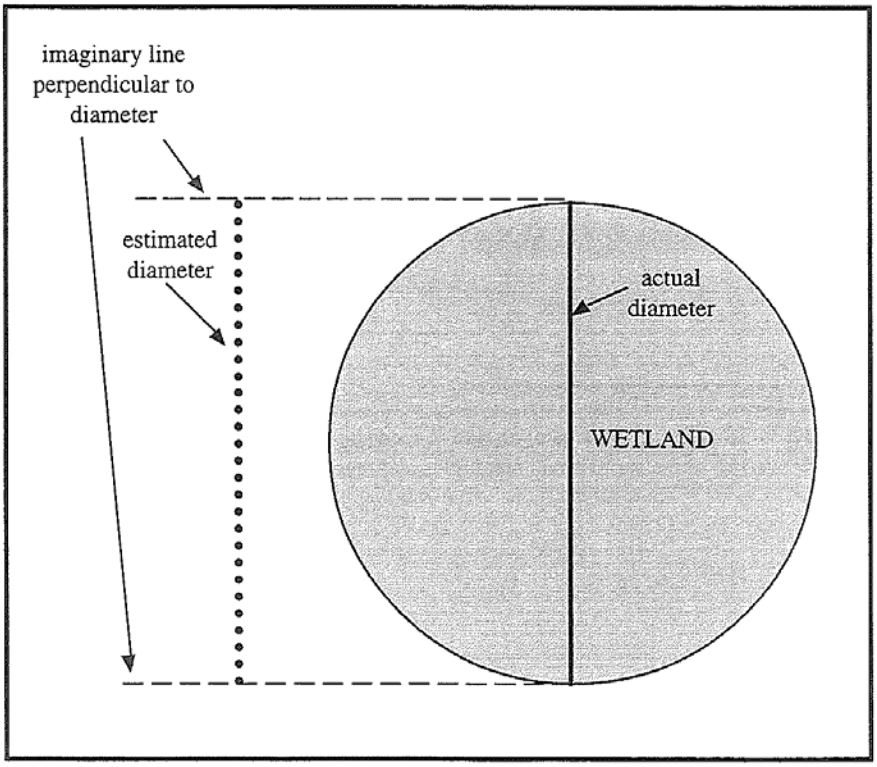


Figure 3. For circular sites, measure the diameter by pacing if off outside the wetland.

For sites that have curved edges but are more elliptical (oval) in shape, measure the diameter of both the length and the width at the widest point (in meters) by pacing off these distances outside of the wetland, using the same procedure as for circular sites. Record all diameter measurements on the data sheet. Then calculate the area of the wetland in m^2 by using the following formula for the area of an ellipse:

Area of an Ellipse = $\pi(\frac{1}{2}L \times \frac{1}{2}W)$, where $\pi = 3.14$

L = maximum length of wetland
W = maximum width of wetland

Record the area on the data sheet.

The last step is to convert area from m^2 or acres to hectares. These units are converted to hectares as follows:

$m^2 \div 10{,}000$ = hectares;
acres x 0.4 = hectares

If no estimate of wetland size is available and the site is too large to rely on pacing to estimate size, but a topographic map with land cover data is available, use the map to estimate wetland size. Photocopy a grid onto a clear sheet of acetate (overhead or transparency sheet), lay it over the topographic map, and count the number of squares that your wetland occupies. Determine the length of one side of each square with a ruler, then apply the scale from the map to determine the length of

one square side in m. Square the length to get m^2, then multiply by the number of squares in the wetland to get total area in m^2 and record. Convert to hectares using the above formula, and record again.

5. <u>Determine the length of the wetland perimeter</u>.

Another way to characterize the wetland patch is to compare its area to the amount of edge that it has. Walk the entire edge of the wetland patch and count steps as you go. This procedure can be done at the same time the wetland area is measured. Record the number of steps. Convert to m and record again. If the site is too large to walk the perimeter, you may have to estimate the perimeter by driving, or by some combination of driving and walking. (Note that 1 mile = 1600 m.) For circular sites, the perimeter may be estimated using the following formula:

Perimeter (Circumference) of a Circle = $2\pi r$, where $\pi = 3.14$, r = radius = ½ diameter

If the site is large, *and* a topographic map with land cover data is available, use the map to estimate wetland size. Take a piece of string and outline the wetland patch on the topographic map. Measure the length of string needed to outline the perimeter of the wetland. Finally, convert that length to actual distance based on the scale of the aerial photo. Record the perimeter distance on the Site Characterization/Establishment sheet.

6. <u>Determine the land cover characteristics for the land around the site.</u>

- **Observe the land around the site**. You will observe the land cover around the wetland from the midpoint of each wetland edge.
- **Record the major land cover in each cardinal direction of the wetland**. Using a compass, look to the north of the site and scan the land cover that can be found between the edge of the wetland to a distance of about 100 meters beyond the edge. A major land cover would be one that makes up greater than 50% of the area viewed. Write on the Surrounding Land Cover sheet the major land cover that best represents the land found to the north of the site. If you observe a major land cover that is not listed, then enter OTHER LAND COVER, and write the name of the land cover in the blank.
- **Record the type of borders (if any) that are within 20 m of the edge of the wetland**. While still looking north, observe if there are any borders found within approximately 20 meters of the edge of the wetland. A border is simply a narrow strip of land that consists of a different type of land cover, or land that is being used differently than the major land cover for that area. Write the border type in the blank labeled Border Type on the Surrounding Land Cover Sheet. If you observe a border type that is not listed, write OTHER BORDER, in the blank. If more than one border occurs (e.g. a railroad with a road beyond it), only record the border closet to the wetland edge.
- **Record major land cover and border types from the south, east, and west directions**.

Possible land covers:

A. Forest: covered with trees and shrubs (≥ 50 % canopy cover)
B. Savanna: grassland with scattered trees (≥ 10% canopy cover, but < 50 % canopy cover)
C. Prairie: grassland with few or no trees (< 10% canopy cover; not plowed, not lawn or pasture)
D. Open Water: lake, large stream or river, large pond

E. Pasture: open, grassy lands that are used for grazing (not plowed, but not lawn) Grazing animals such as cows and horses need not be present.
F. Cropland: annually plowed agricultural fields such as for raising corn and soy beans
G. Residential: single or multi-family dwellings; includes farm buildings, apartments
H. Commercial: non-residential, larger buildings such as stores or offices, in predominantly paved areas
I. Industrial: manufacturing or processing plants
J. Shrub: habitats dominated by shrubs or tree saplings (often abandoned fields)
K. Other (Specify: _____)

Possible Borders:

1. Paved Road
2. Unpaved Road
3. Railroad
4. Hedgerow (e.g., Osage orange)
5. Stream
6. Electric Power Lines
7. Dump Site
8. Building(s)
9. None
10. Other (Specify: _____)

Procedure – Establishing a New Site

1. <u>Locate the center point for the baseline.</u>

Select an edge of the wetland that is a least 50 m long, that is reasonably straight and accessible, and that borders at least 50 m of wetland vegetation toward the wetland interior. Go to the middle of this edge or as close to it as reasonably possible. Drive a stake into the ground to permanently mark the **center point**. Mark this stake with a tag that has been pre-marked "B - 25 m." This point will be used to center the baseline along the edge of the wetland. If you are using a global positioning system (GPS unit), you should take a latitude/longitude reading right at the center point, then record those coordinates on your Site Sketch Sheet.

2. <u>Establish the baseline.</u>

The 50-m baseline is established along the edge of the wetland so that the 25 m mark is right at the center stake. Stand at the center point facing the wetland. One person now walks from the center point toward the left along the edge for exactly 25 m, holding the end of the 50-m rope marked "0" and a stake that has been pre-marked "B - 0 m." As this person proceeds, a partner stands at the center point letting out 25 m of rope. When the walker has gone 25 m, drive the stake into the ground to mark 0 m. Tie the rope to the stake so that the 0-m mark on the rope is right at the stake.

Next, take a compass bearing from the 0-m stake to the center point. Record this bearing on the Site Sketch sheet. Now return to the center point, pick up the rope, walk in the opposite direction for 25 m on the exact same bearing which you recorded on the data sheet, and drive a stake marked "B - 50 m" into the ground at the 50-m point. Tie the rope to this stake so that the 50-m mark on the rope is right at the stake. The 50-m baseline should form a straight line.

To use your compass: Point the base plate in the exact direction you want to go and turn the dial (keeping the baseplate still) until the needle is lined up with N on the ring. Determine your bearing from the ring of your compass, and record the bearing.

3. Randomly select a starting point for the plant-monitoring transect.

Write the 5-m intervals (e.g., 5 m, 10 m, 15 m, etc.) on small slips of paper and place them in a small container or bag. Do not include 0 m and 50 m in this procedure. Without looking at the numbers on the papers, one person should select a slip of paper from the container. The number on the slip of paper chosen will be the location on the baseline at which the transect will begin.

4. Lay the transect line.

Go to the point on the baseline that was randomly selected for the transect starting point. Drive a stake "T - 0 m" into the ground to permanently mark the starting point, then tie the transect rope to the starting-point stake so that the 0-m mark is right at the stake. (See Figure 4.) If a GPS unit is being used, take another reading at the starting point and record the coordinates on the Site Sketch Sheet.

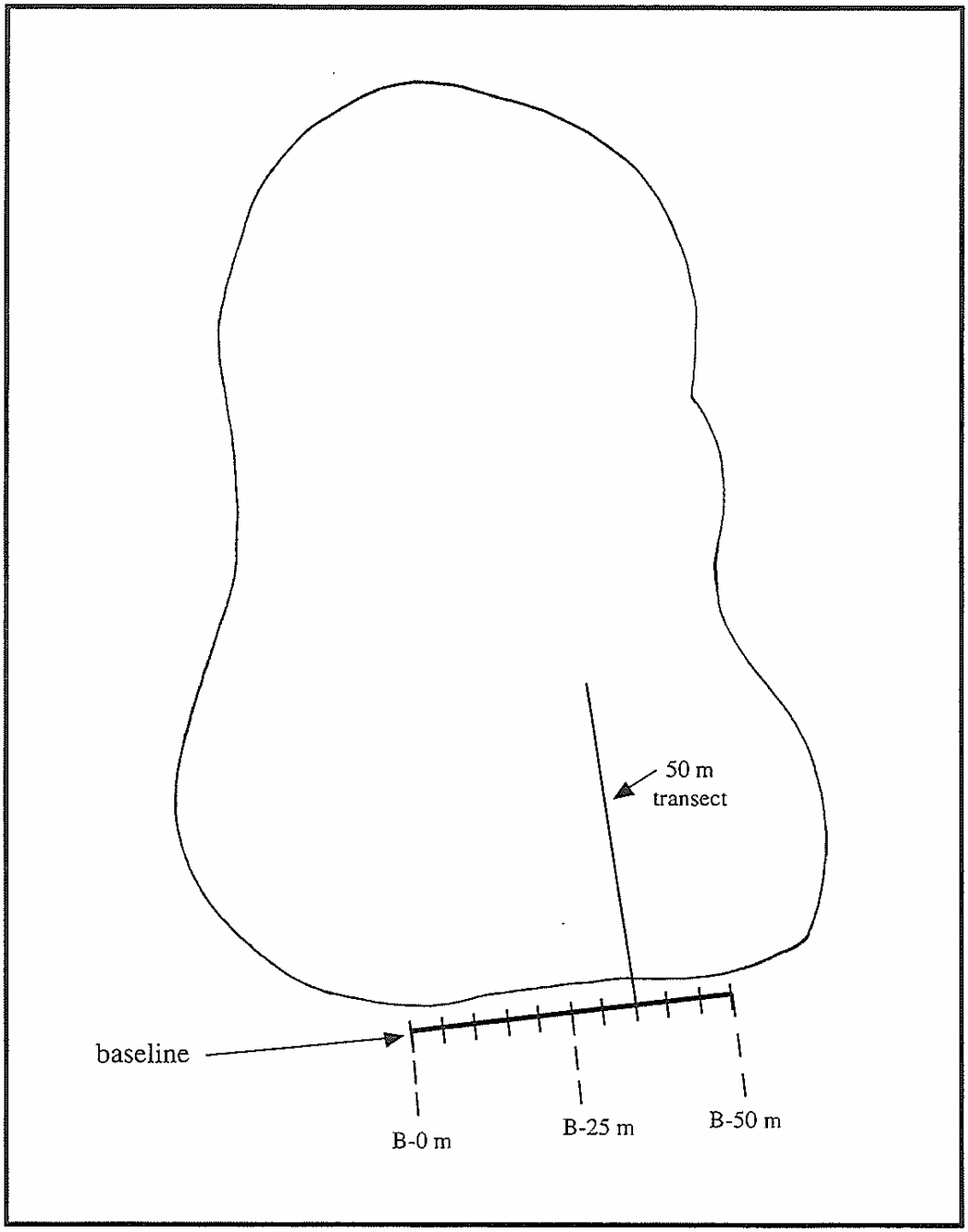


Figure 4. Laying baseline and transect line.

Determine the compass bearing of the baseline that was just established. Record this bearing on the Site Sketch Sheet. Now determine the compass bearing directly into the wetland, perpendicular to the baseline. This will be the bearing for the transect; record this bearing on the Site Sketch Sheet.

Identify a large plant or other visual landmark directly on line with your bearing, walk directly toward it with the rope, then repeat as necessary until you reach 50 m. An easy way to do this is to have one person stand over the stake with the compass and direct the person with the rope, who walks in the direction indicated. Run the 51-m rope from the starting point of the transect to the ending point, **making sure the line is straight** along the compass bearing. Pull the transect line

tight (no slack), then drive the second stake marked "T - 50 m" into the ground at exactly 50 m and attach the rope so that the 50-m mark on the rope is right at the stake.

If the ground is either under water or will not hold a stake when the rope is tied off, do not use a stake at the 50-m point. Simply pull the rope as tight as possible, then leave the rope on the ground unattached.

If open water or other unsuitable habitat is encountered somewhere along the 50 m transect, first complete the plant monitoring on the transect through the end of the last full 10-m interval, then remove the transect rope from the stakes, return to the baseline, and run another transect at another randomly selected point along the baseline. Use the same procedure for randomly selecting a starting point. Continue monitoring along the second line until 50 m are completed on the first and second lines. (See Figure 5.) **Small patches of open water along the transect do not require that you break the transect.**

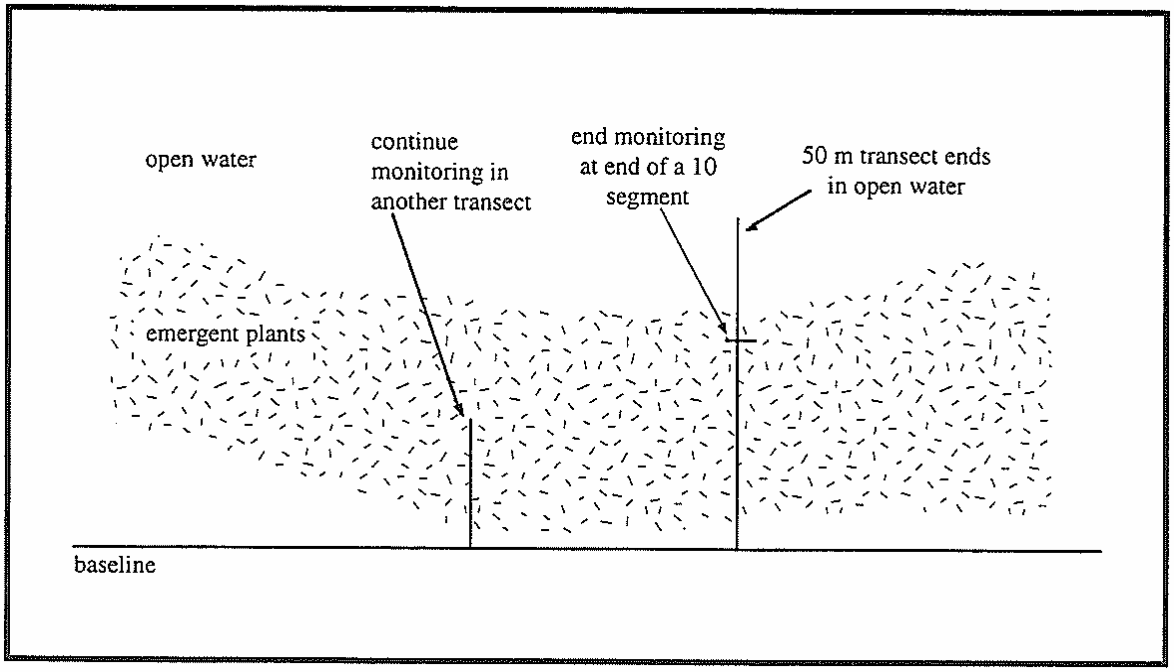


Figure 5. If open water or other unsuitable habitat is encountered, complete the plant monitoring through the end of the last full 10-m interval, then run another transect at another randomly selected point along the baseline.

5. <u>Draw a site sketch so that others may find the site.</u>

Make a sketch of the site showing the location of each stake. Include all compass bearings and GPS coordinates (if taken) for the site. Include any distinctive, reasonably permanent landmarks in your sketch, such as proximity to roads, fence posts, road signs, buildings, land forms, streams, rocks and possibly large trees. Don't use ephemeral landmarks such as a bird's nest which may not last from season to season. (See Figure 6.)

For each stake, if any distinctive features are available close by, pick one of these features (a large tree, for example) and determine the compass bearing from the feature toward the stake. You can do this by going to the feature, pointing the direction arrow on the base of the compass at the stake

and twisting the dial until the needle lines up with North. The compass bearing will be the number of degrees right below the direction arrow on the compass.

Now, measure the distance to the stake with a 51-m rope, meter stick, or by pacing. On your map, you should sketch the feature, the compass bearing, and the distance in meters. Repeat this for <u>two</u> other features for that stake, if available. Do this process for all stakes.

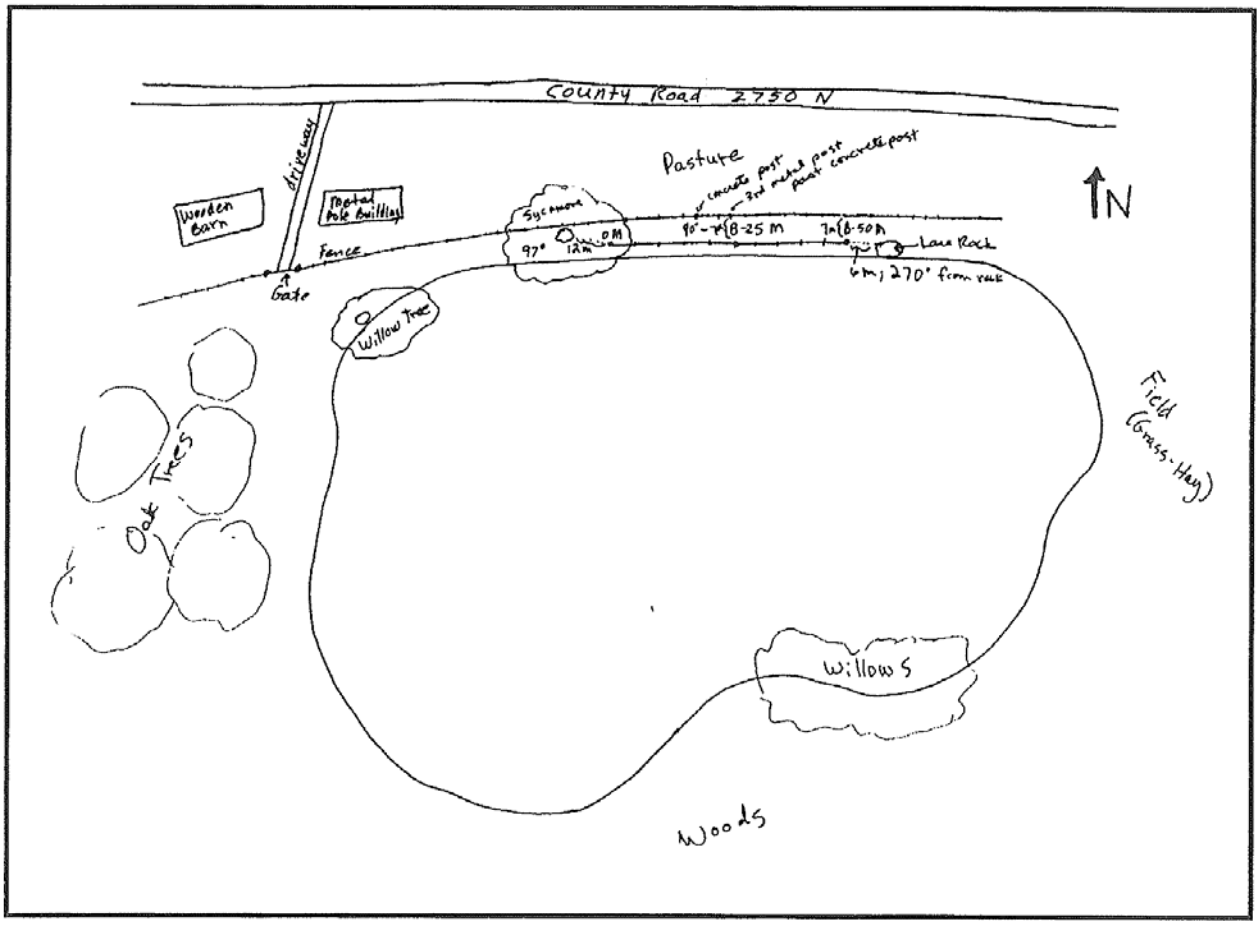


Figure 6. Site Sketch as it may appear on Site Sketch Sheet.

Procedure Summary: Site Characterization/Establishment

Site Characterization

1. Check with landowner or manager regarding past and present use of the site.
2. Determine the number of steps per 50 meters.
3. Note on site any additional signs of past or current human uses.
4. Estimate the size of the wetland.
5. Determine the perimeter length.
6. Determine surrounding land cover and habitat characteristics.

Establishing a New Site

1. Locate the center point for the baseline.
    - Select an edge that is at least 50-m long, straight and accessible, that borders at least 50 m of wetland interior.

- Go to the middle of the edge and mark the center point with a stake.

2. Establish the baseline.
    - Stand at the center stake facing the wetland, then walk with the rope to the left for 25 m and drive a 0-m stake into the ground at the point where the rope runs out.
    - Tie a 51-m rope off so that the 0-m mark is right at the 0-m stake.
    - Take a compass bearing from the 0-m mark toward the center point.
    - Return to center stake, then lay out rope on baseline bearing to the 50-m point on other side of center stake.
    - Drive 50-m stake into ground.
    - Tie rope so that 50-m mark is right at the 50-m stake.
3. Randomly select a starting point for the plant-monitoring transect.
    - Write the 5-m intervals on small pieces of paper (omit 0- and 50-m marks) and place in container.
    - Select a slip of paper from the container; the number on the paper indicates location on baseline at which transect will begin.
4. Lay the transect line.
    - Go to transect starting point, drive stake marked "0 m" into ground.
    - Tie transect rope off so the 0-m mark is right at the stake.
    - Determine compass bearing of baseline.
    - Determine bearing directly into the wetland, perpendicular to the baseline; this is the transect bearing.
    - Have one person with compass stand over the stake and direct the person with the rope.
    - At 50 m, drive 50-m stake into the ground, pull rope tight, and attach so that the 50-m mark is right at the stake.
    - If ground is under water or too soft to hold stake when rope is attached, pull rope tight and leave unattached.
    - If open water or other unsuitable habitat is encountered somewhere along the 50-m transect, complete plant monitoring through the last full 10-m interval, return to the baseline and run another transect at another randomly selected point along the baseline.
5. Draw a site sketch so other may find the site and stakes.

Locating an Existing Site

1. Locate the 0-m, center, and 50-m points of the baseline, then mark the baseline with a 51-m rope.
2. Locate the 0-m and 50-m points of the transect, then mark the transect with a 51-m rope.
3. Note any observed change in the use or management of the site and surrounding land.

PLANT SURVEY

Task:
To conduct a survey of herbaceous plants and woody vegetation in an emergent (vegetation rooted in the water but growing above the surface), palustrine (marsh-like) wetland based on a transect line and a baseline.

Purpose:
The presence of herbaceous non-native, invasive non-native and native, and disturbance-sensitive native plants in a wetland provides baseline data for determining long-term changes that are taking place in the ecological condition of wetlands. Extensive populations of disturbance-sensitive plants indicate relatively good ecological health. Such plants that are being crowded out by non-native (from other parts of the world) or invasive natives (aggressive species that soon form monocultures) are indications that some type of disturbance has occurred. In addition, the degree to which woody vegetation changes in a wetland may indicate long-term changes in the structure of the wetland community. For example, a marsh that has had its hydrology altered, may be changing into a forested community.

Materials (for baseline and one transect):

- meter stick
- 4 tent stakes for baseline
- two 51-meter ropes (for baseline and transect)
- 50-meter tape measure
- 2 pvc or wood 1/4 m^2 sampling quadrats
- 4 aluminum tent stakes

Procedure:
Conduct both quadrat sampling and woody vegetation cover along the transect at the same time to minimize trampling of the transect line.

Plant Survey: General Information for Quadrats

1. Reestablish the baseline and transect as described in Site Characterization and Establishment.
2. Herbaceous vegetation will be surveyed in ¼ m^2 quadrats at 2-m intervals along the transect until 20 quadrats have been surveyed. Using your meter stick, measure to the 2-m point on the transect. Place the quadrat in the area on the left side of the transect in the area between 2 – 2.5 m along the line and between 1 – 1.5 meters from the line (see Figure 7).
3. The next quadrat is laid on the right side of the transect, between 4-4.5 m along the line and between 1 – 1.5 m from the line. Proceed to sample the quadrats by alternating sides in this manner (left, right, left, right, etc.).
4. If there is not a sufficient amount of palustrine/emergent vegetation habitat (open water is not considered part of the habitat and transects should be terminated when a large body of open water is encountered) on the first transect (i.e. < 50 m), return to the baseline and run another transect at another randomly selected point along the baseline. **Note: Do not terminate the transect if only small patches of open water are encountered with more vegetation beyond them.** The second transect must be at least 4 m from the first transect. This transect need only be long enough to complete the 20 plots.
5. Continue surveying until the 20 quadrats have been completed.
6. To save the time and minimize trampling, have one person on each side of the transect line sample the ten quadrats and do the woody vegetation survey. Make sure that the samples are staggered as outlined above.

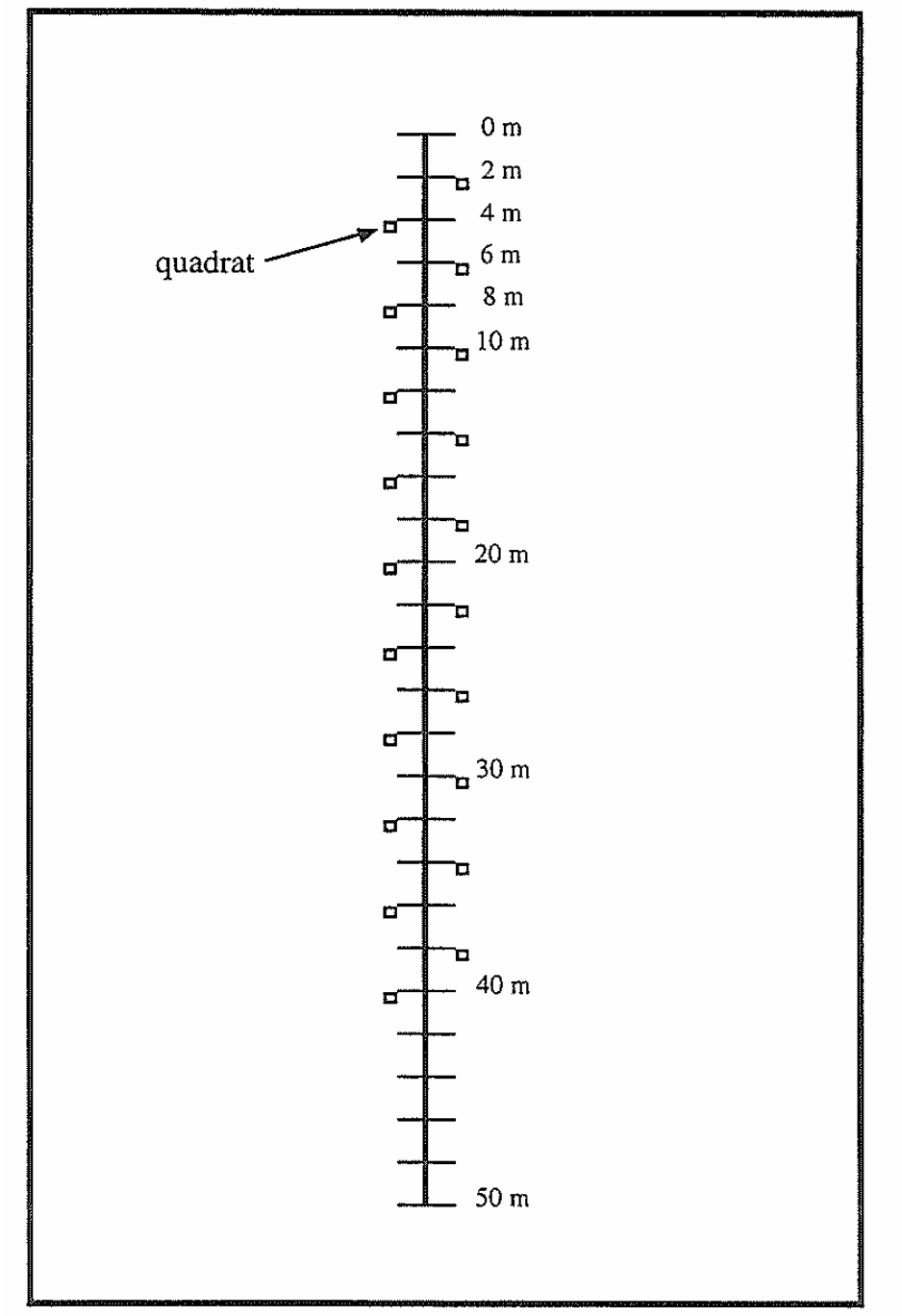


Figure 7. Laying out the quadrats.

Within ¼-m^2 quadrats measurements: herbaceous cover

1. Estimate the percentage of vegetation cover for each target species rooted inside each ¼-m^2 quadrat. The estimates will be fitted into cover classes of 0, 1-5%, 6-25%, 26-50%, 51-75%, and 76-100%.

2. Estimate the total overall percentage of herbaceous vegetation cover for each quadrat (e.g., herbaceous vegetation cover vs. the soil surface, open water, or woody vegetation cover).

Transect sampling: woody vegetation stems (< 5 cm in diameter and > 1 m tall)

1. Conduct this survey along the transect while surveying the herbaceous cover of quadrats. (See Figure 8). For each woody species (see list of target woody species) count the number of stems that are rooted within 1 m on either side of the transect. Do not limit your counts to only those woody species listed below. Identify only those listed below, but count all woody stems and list them as "other."

2. Sample all 50 meters of the transect. Note: if you had to establish two transects, sample only a total of 50 meters.

Target Species to be Surveyed

non-native or invasive plants

cattail (common and narrow-leaved) *Typha latifolia, Typha angustifolia*
purple loosestrife *Lythrum salicaria*
reed canary grass *Phalaris arundinaca*
phragmites *Phragmites australis*

disturbance-sensitive plants

marsh marigold *Caltha palustris*
arrow arum *Peltandra virginica*
marsh fern *Thelypteris palustris*
marsh skullcap *Scutellaria galericulata*
royal fern *Osmunda regalis*
cinnamon fern *Osmunda cinnamomea*
closed gentian *Gentiana andrewsii*
white water lily *Nymphaea odorata*
yellow pond lily *Nuphar luteum*
tufted loosestrife *Lysimachia thrysiflora*

woody plants

willows
red ozier dogwood
buttonbush
buckthorns (woody) *Rhamnus cathartica, Rhamnus frangula*

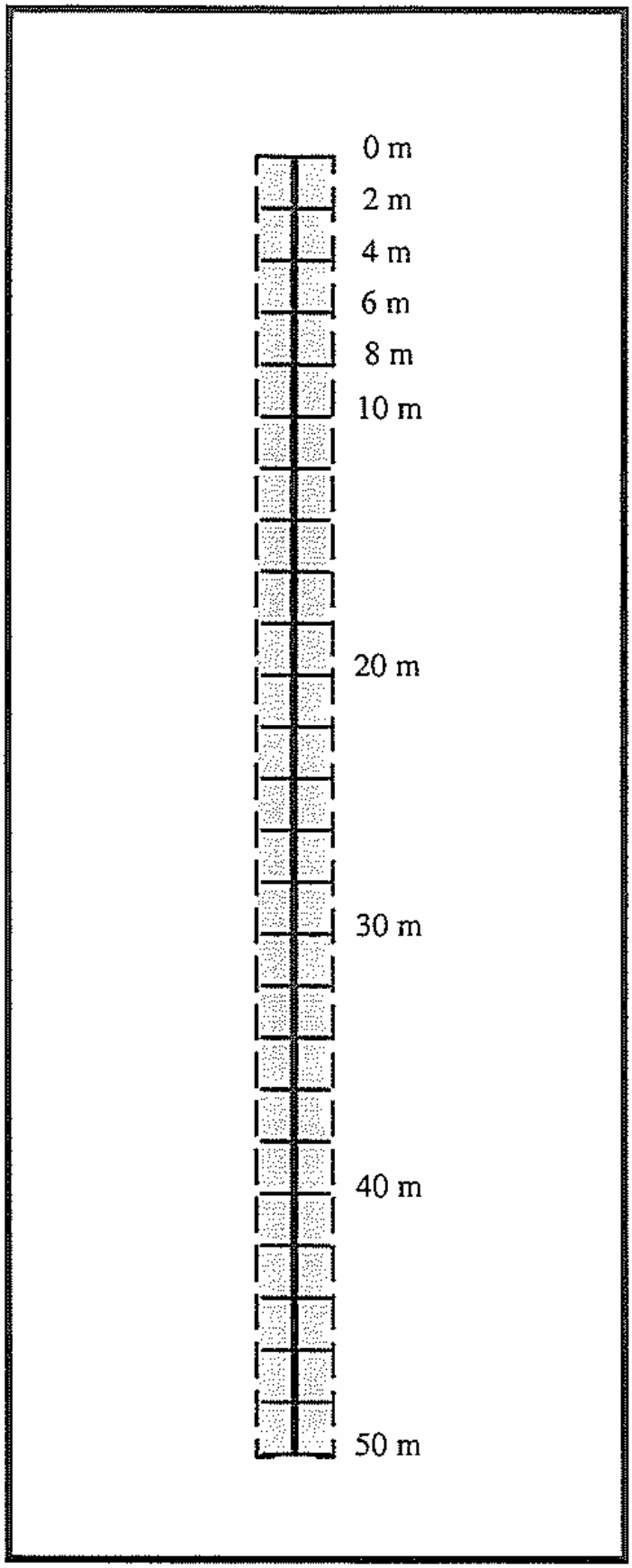


Figure 8. Shaded area represents sampling area for woody vegetation stems.

Survey-plot measurements: large tree survey (> 5 cm diameter at breast height, or dbh, and at least 1 m tall)

1. Establish a plot with the dimensions of the length of the baseline (50 m) and the length of the longest transect (maximum of 50 m x 50 m). (See Figure 9). **Avoid areas with deep water!!**

2. Measure the dbh of all trees ≥ 5 cm dbh and record their species. Use a tree field guide to determine species of tree. Below is a list of trees likely to be encountered in Illinois wetlands.

3. Plot the locations of the trees in the surveyed area on the data sheet.

Typical Illinois Wetland Trees

tamarack (north)
bald cypress (south)
boxelder
swamp red maple (south)
silver maple
river birch
sweet gum (southern half)
water tupelo (south)
sycamore
cottonwood
swamp white oak
pin oak
various willows
elm
shellbark hickory (southern 2/3)
pumpkin ash (south)

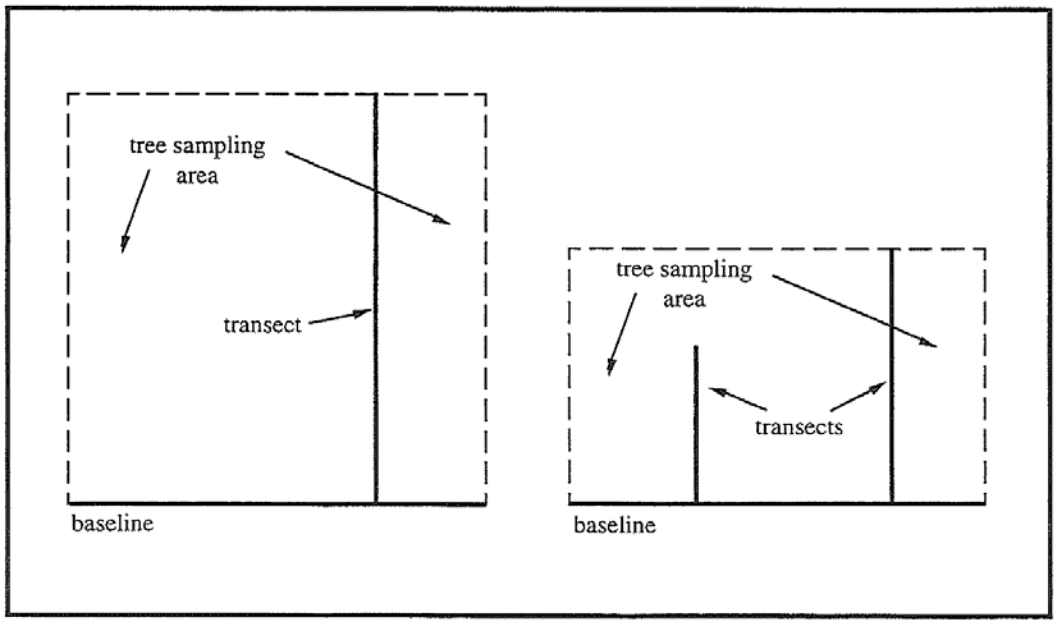


Figure 9. Large tree sampling area.

Procedure Summary: Plant Survey

1. Sample herbaceous vegetation cover in 20, ¼- m^2 plots along transect.
2. County woody stems along 50 meters of transect.
3. Count and measure dbh of trees in total plot (maximum size 50 m x 50 m).

Vegetation Zones: Remote Sensing

Task:
To determine the relative percentages of emergent vegetation, floating vegetation, and open water in a wetland habitat – to assess vegetation zones.

Purpose:
This procedure will provide information on the dominant vegetation and habitat zones in a wetland.

Materials:
- vegetation assessment column (VAC) (10% or 20%) (see Equipment section for construction instructions)
- 6-8 foot step ladder
- plywood strips on which to position ladder (optional)
- tape measure

Procedure:
1. Use the 50-meter long baseline for this assessment. You will take readings every 5 meters beginning at the 5-meter point on the baseline and ending on the 50-m point. These are called visual transects.

2. A reading consists of a measurement at each point – 10 measurements in total.

3. Each measurement is taken from a step ladder positioned 10 m from the edge of the wetland (20% of distance across the sampling area). The ladder should be on dry ground, or relatively so. If the feet of the ladder sink into the ground, place strips of plywood on the ground and set the ladder on them. Use caution on the ladder and have assistants to hold it steady! Climb the ladder until you can see across the wetland, with your eyes at a maximum of 3.3 m (10 ft.) off the ground. Face into and across the area of the wetland where the plant surveys were or are to be conducted. Thus, the area to be surveyed is the 50 m of the baseline x the 50 m of the transect. If your transect was subdivided, you will still use the 50 m length as your starting point for each measurement. Estimate the additional distance from the subdivided transect to the 50-m point and place the narrow end of the VAC there. (See Figure 10.)

4. To take a measurement from the ladder positioned back 10 m from the edge of the wetland (i.e., 20% of the distance across the sampling area of 50 m), hold the 20% VAC with your eye at the center line of the column, parallel to your eyes, parallel to the long axis of the wetland, and perpendicular to the ground. Have a partner observe from the side and state when the VAC is perpendicular to the ground. Position the top of the VAC slot at the top edge of the sampling area and the bottom of the VAC slot at the closet (bottom) edge of the wetland. Do this by moving the VAC closer to or further away from your eyes. Remember, the VAC column must include the entire 50-m sampling area! Using the five zones in the column (each with grids on the inside), count the number of grids in each cell with the three zones of vegetation: emergent vegetation, floating-leaved vegetation, and open water. The grid is a guide to help estimate the percentage of area covered. Each grid section of the nearer cells represents 5% of the cell being surveyed. For example, if Cell 5 (bottom of the VAC and near edge of the sampling area) is gridded into 20 parts and open water occupies 7 of them and floating vegetation 13, then Cell 1 has 35% open water and 65% floating-leaved vegetation). Each grid section of the farther (upper) cells represents 20% of the area of the cell. The differences in the size of the cells does

not matter as they are calibrated to sample equal areas. Continue viewing down the VAC to the near edge and survey each of the five cells. That completes a reading. Report your readings to an assistant. Do not attempt to enter the data while on the ladder. **Remember, once you start a reading, do not move the VAC as this will alter the reading.**

In cases where it is impossible to place the ladder 10 m from the edge (some obstruction, etc.), the ladder may be placed 10% of the distance (5 m from the edge) and use the 10% VAC. Make sure you designate on the data sheet which distance you use and do not mix distances. All measurements must be made from either 10 m or 5 m from the edge!

Also note that the height of the VAC from the ground is irrelevant to the reading. The reason for using a ladder is that it allows the volunteer a better view of the wetland (over shoreline vegetation) and makes estimating the percentages of habitats found in each cell considerably easier. If you can see enough of the wetland without using the ladder, do not use the ladder.

5. After completing the first reading, move the step ladder to the next point (10-m point) along the baseline and an appropriate distance from the edge and repeat the procedure. Your views through the VAC should not overlap, but be parallel to each other.

6. Continue along the baseline until you have completed all 10 readings.

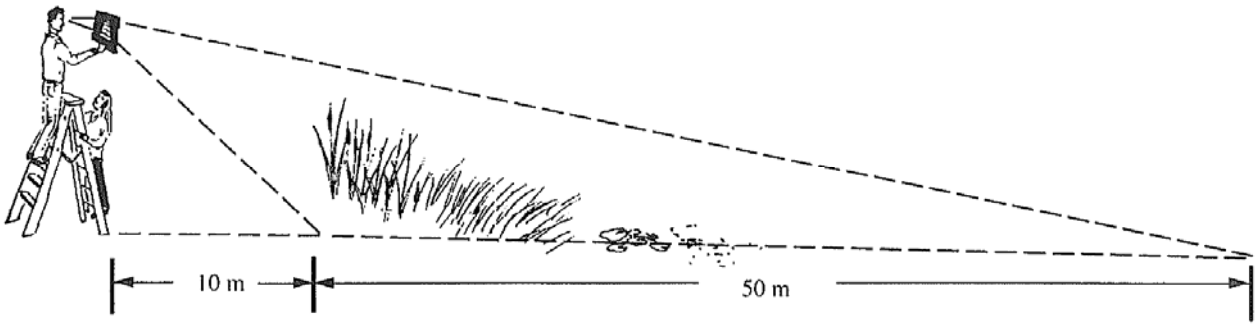


Figure 10. Using the VAC.

Procedure Summary: Vegetation Zones

1. Position a step ladder along baseline of wetland at appropriate distance from baseline.
2. Take 10 measurements with the VAC from the 50m x 50m sampling area.
3. Record the percentage of emergent plants, floating-leaved plants, and open water from each cell at each distance along the transect.

Appendix A - Data Sheets

WETLAND SITE CHARACTERIZATION/ESTABLISHMENT FORM

Date: _____

Wetland Name: _____
If a name is not known, use UNKNOWN WETLAND or name the site after the landowner.

1. **Owner/Manager Access Permission:** ____ YES ____ NO
   An X in the YES space also indicates that a PROPERTY OWNER ACCESS PERMISSION form (or an equivalent research or other permit as may be required on publicly owned land) has been signed and completed for this site.

   Landowner's Name: _____**Phone Number**: _____

2. **Directions to Site**: _____

   _____

3. **Suitability of Site:** Evaluate the site according to the physical and safety criteria.

   PHYSICAL SUITABILITY

□ Location	The site must have dimensions equivalent to 2500 m^2 (e.g., 50 m x 50 m, or equivalent).
□ Habitat Characteristics	Any palustrine (marsh-like) emergent wetland is suitable if it has vegetation. Artificially constructed wetlands are suitable. The wetland site must have < 50% woody shrub or tree cover. Riverine (habitats along streams or rivers) with emergent vegetation are not considered suitable.

   SAFETY

□ Safe Access	The site must be safely accessible for monitoring activities.

4. **General Observations:** _____

_____

_____

5. Landowner Interview: Ask the landowner about the past and present uses of the site you are monitoring.

_____

_____

_____

6. Number of steps that equal 50 m _____

7. Signs of Human Use:

_____

_____

_____

8. Size of the Wetland:

9. Length of the Wetland Perimeter:

SITE IDENTIFICATION FORM

1. WETLAND NAME: _____
If the name of the wetland is unknown write "UNKNOWN WETLAND" or ask the people who live in the area if they know of a name for the wetland, or name the wetland after the landowner.

2. COUNTY: _____

3. LOCATION DESCRIPTION:_____

_____

4. LATITUDE: _____ LONGITUDE: _____

SURROUNDING LAND USE

Site Name: _____
Date: _____
Your Name:

Write the name of the predominant land use and border type in each cardinal direction from the center of the wetland in the spaces provided.

NORTH

LAND USE: _____
(_____)

BORDER TYPE: _____
(_____)

W E S T

LAND USE: _____
(_____)

BORDER TYPE: _____
(_____)

LAND USE: _____
(_____)

BORDER TYPE: _____
(_____)

E A S T

LAND USE: _____
(_____)

BORDER TYPE: _____
(_____)

SOUTH

SURROUNDING LAND USE

LAND USE	*BORDER TYPE*
FOREST	PAVED ROAD or PARKING LOT
SAVANA	UNPAVED ROAD
PRAIRIE	RAILROAD
OPEN WATER	HEDGEROW
PASTURE	STREAM
CROPLAND	ELECTRIC POWER LINES
RESIDENTIAL	DUMP SITE
COMMERCIAL	BUILDING
INDUSTRIAL	NONE
SHRUB	OTHER
OTHER	

SITE SKETCH SHEET

Make a sketch of the site, to scale, that highlights the main features of the area (streams, bodies of water, power lines, etc.). Be sure to mark which direction is north. Indicate land use on the map for the areas bordering the wetland. Mark the highest and lowest elevations as indicated by the topographic map. Write notes and observations below the sketch or on back.

WETLAND NAME: _____
COUNTY: _____
DATE: _____

Size of Wetland: _____m^2
Length of Wetland Perimeter: _____m

DATE: _____
TRANSECT NUMBER: _____

PLANT SURVEY
Percent cover of non-native and disturbance-sensitive wetland plants.
***Determine the % of cover for each species listed within each ¼-m^2 plot. Use the % cover class provided.**

SPECIES	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Cattail																				
Purple Loosestrife																				
Reed Canary Grass																				
Phragmites																				
Marsh Marigold																				
Arrow Arum																				
Marsh Fern																				
Marsh Skullcap																				
Royal Fern																				
Cinnamon Fern																				
Closed Gentian																				
White Water Lily																				
Yellow Pond Lily																				
Tufted Loosestrife																				
TOTAL HERBACEOUS COVER																				

% COVER CLASSES
A = 0% - 5%
B = 6% - 25%
C = 26% - 50%
D = 51% - 75%
E = 76% - 100%

PLANT SURVEY

WOODY VEGETATION SURVEY

*Determine the number and species of woody stems rooted within 1 m of 50 total meters of the transect.

WOODY PLANTS	TALLY	Number in 50 m
Willows		
Red Ozier Dogwood		
Buttonbush		
Buckthorn		
Other Wood Plant		

% COVER CLASSES

A = 0% - 5%
B = 6% - 25%
C = 26% - 50%
D = 51% - 75%
E = 76% - 100%

DATE: _____
TRANSECT NUMBER: _____
YOUR NAME: _____

PLANT SURVEY

LARGE TREE SURVEY

*Record the baseline length and longest transect length for the study area, then record the number and species of trees ≥ 5 cm dbh rooted within the study area.

Baseline Length (check one): □ 50 Meters □ Other (actual length) _____ meters
Longest transect length (check one): □ 42 Meters □ Other (actual length) _____ meters

DBH SIZE CLASSES

TREE NAME	A 0 cm – 5 cm	B 5.1 cm – 10 cm	C 10.1 cm – 20 cm	D 20.1 cm – 30 cm	E 30.1 cm – 40 cm	F 40.1 cm – 50 cm	G 50.1 cm – 60 cm	H > 60 cm
TAMARACK (northern Illinois)								
BALD CYPRESS (southern Illinois)								
BOXELDER								
SWAMP RED MAPLE (southern Illinois)								
SILVER MAPLE								
RIVER BIRCH								
SWEET GUM (southern Illinois)								
WATER TUPELO (southern Illinois)								
SYCAMORE								
COTTONWOOD								
SWAMP WHITE OAK								
PIN OAK								
VARIOUS WILLOWS								
ELM								
SHELLBARK HICKORY (southern 2/3)								
PUMPKIN ASH (southern Illinois)								

NOTE: For all trees with dbh > 60cm, record the actual dbh measurement. Write neatly so that more than one measurement may be written in the space provided.

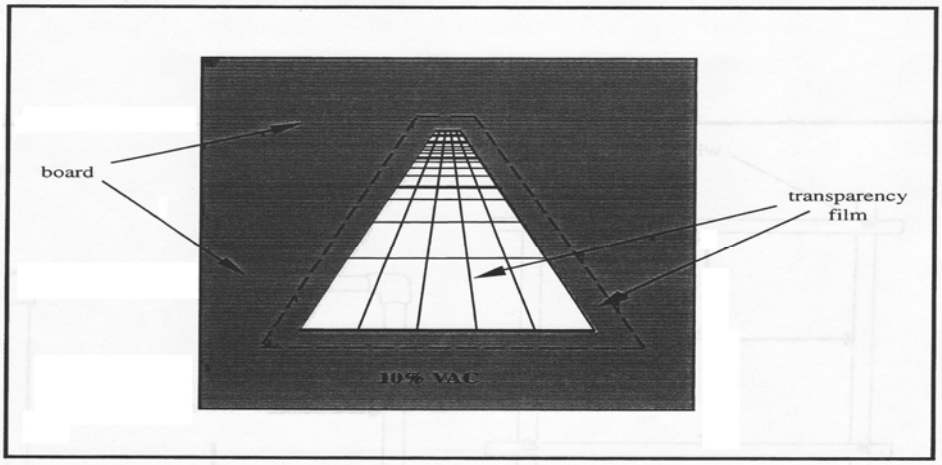
VEGETATION ZONES: Remote Sensing

For each of the ten survey points, circle the ladder distance from the baseline. Then determine the percentage of each plant group in each cell.

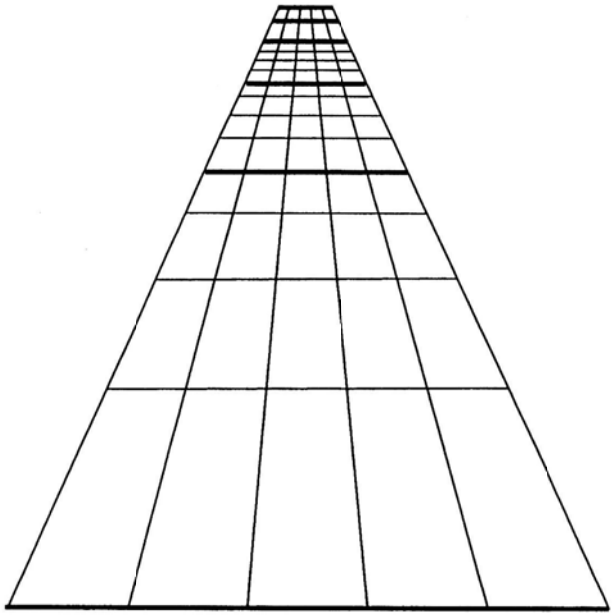
		1	2	3	4	5
5 METERS	**Ladder Distance**					
	5 m 10 m					
10 METERS						
	5 m 10 m					
15 METERS						
	5 m 10 m					
20 METERS						
	5 m 10 m					
25 METERS						
	5 m 10 m					
30 METERS						
	5 m 10 m					
35 METERS						
	5 m 10 m					
40 METERS						
	5 m 10 m					
45 METERS						
	5 m 10 m					
50 METERS						
	5 m 10 m					

APPENDIX B

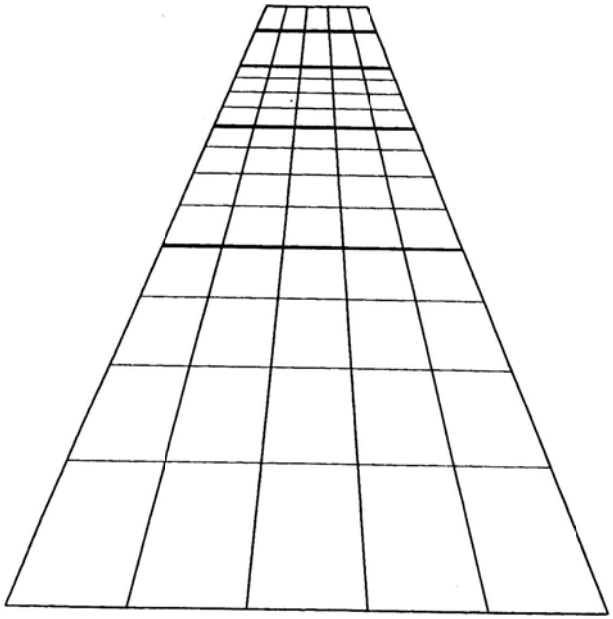
PATTERNS



VAC construction



10% VAC



20% VAC