# CLASS OF 1918 MARSH

DEDICATED TO THE

CLASS OF 1918

THE UNIVERSITY OF WISCONSIN

WHOSE GOLDEN JUBILEE REUNION GIFT

OF MAY 19, 1968 HELPED MAKE

POSSIBLE THE PRESERVATION OF THIS

BEAUTIFUL NATURE AREA

UNIVERSITY OF WISCONSIN FOUNDATION

MAY19, 1972


**ACKNOWLEDGEMENT**

Four essential elements contributed to this project. **First**, the U.W. class of 1918 provided the interest and financial support. **Second**, the design, construction, planting and printing entailed much work by the U.W. Planning and Construction Department, especially by Professors Robert Stein and Richard Tipple. **Third**, city and university community concern for preservation and educational use of wetlands were focused through student groups - especially with the continuing interest and groundwork of Richard McCabe - and through organizations such as the Southern Wisconsin Wetlands Association. **Fourth**, the interpretive signs, advice, and continuing management came from the U.W. Arboretum. Some of the line sketches were contributed by my wife, Elizabeth. The success of this venture depends on follow-through over the years. The opportunities are exciting. -- James H. Zimmerman, U.W. Arboretum Naturalist and Lecturer, Institute for Environmental Studies

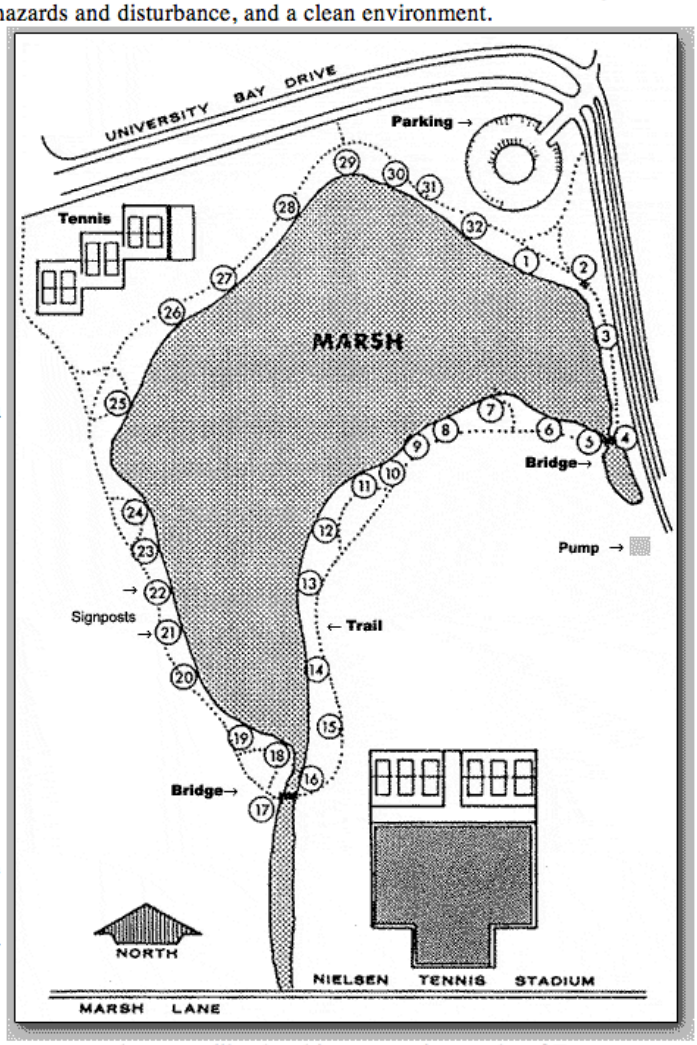
## Sign 1 - UNIVERSITY BAY MARSH DEMONSTRATION PROJECT CLASS OF 1918

**(Click on the sign number to see the sign)**

The purpose of this small wet marsh--amid playing fields, parking lots, and roads and buildings--is to foster an appreciation of marshes and to demonstrate how wildlife and people can coexist. With proper understanding and public cooperation, the similar needs of man and of wildlife can be met side by side: living space, food, protection from hazards and disturbance, and a clean environment.

The developments here, including earth-moving, the nature trail, interpretation signs, and plantings, were made possible by generous donations from the UW Class of 1918.

Thirty-two signposts along the trail are indicated on the map. It should take an hour or two to sample this circuit in a leisurely stroll. With patience, you will see a variety of birds and other wildlife. As plants develop and animals come and go, the scene will change each week through. the season from ice breakup at the end of March, until November freeze-up. Even in winter, animal tracks, roosting rabbits and pheasants, small finches and snow patterns will continue the drama.




**This marsh is noteworthy in five ways:**

1) It is a man-made restoration; successes and failures may be studied here for future understandings of the ecosystem.

2) It is an educational facility, bringing people and the natural environment intimately together. Here man may also derived recreational benefit, while wildlife may eventually become more accustomed to man, like the chimney nesting storks of Europe.

3) It would be too small a marsh to hold much wildlife were it not for its proximity to a complex of lakes in the Wisconsin River flyway. Attracted to the waterway, and perhaps bound to it by traditions handed down, large numbers of' water birds expect to find and almost desperately seek marshes for resting, food and nest sites. So few marshes are left that every small one receives abnormally intense use.

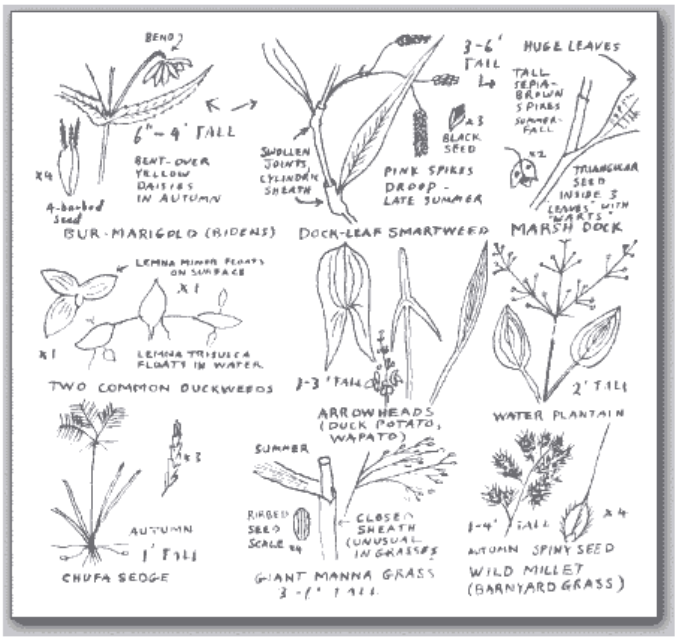
4) It is now in the early very weedy stages of development following recent construction causing erosion and siltation. The upland and lowland weeds are not being cut because: (a) they provide important wildlife foods and immediate temporary cover; (b) natural succession can be studied here. Stabilizing of the vegetation and clearing of the water will come only with cessation of construction and soil disturbance in the entire watershed.

5) Its existence is testimony to the sizeable body of people in city and on campus who appreciate nature. We hope this project will encourage marsh restoration and interpretation elsewhere. A pamphlet reprinting these signs is available from The University of Wisconsin Arboretum, 1207 Seminole Highway, @ $1.00

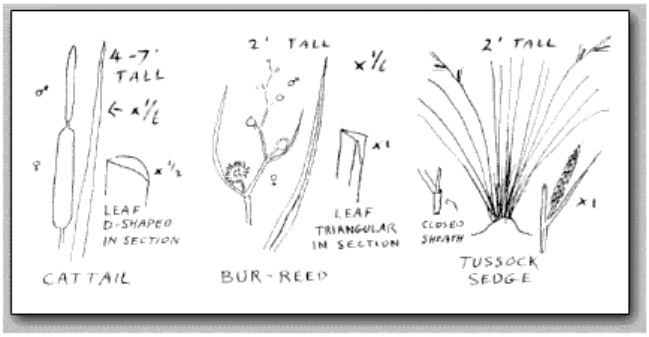
## Sign 2 - IMPORTANT MARSH PLANTS

The modern world of life depends on green plants for converting solar energy into potential chemical energy -- in the foods we eat. During the day, green plants carry on photosynthesis faster than respiration, yielding a net gain in carbohydrate and atmospheric oxygen at the expense of carbon dioxide and a little water.

But plants are also important in shaping the landscape for animal habitats. They take part in successions in which different vegetations follow each other, from the quick, short-lived, weedy "pioneers" to the crowding-tolerant, permanent or "climax" types.

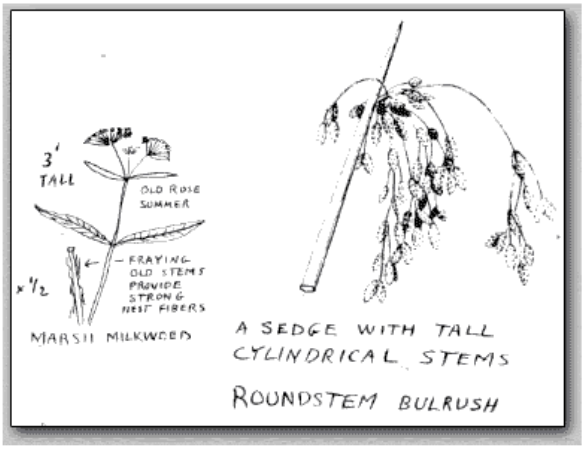


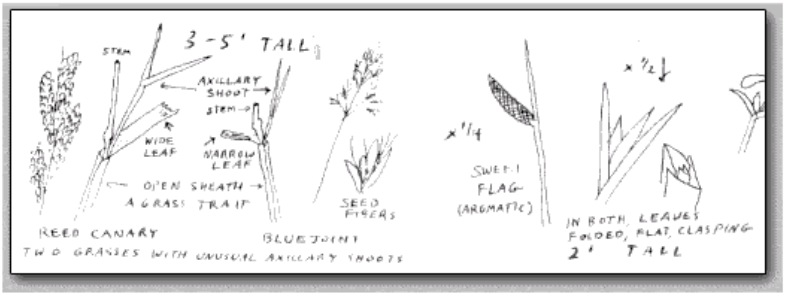

In the lawn edge by the parking lot, for example, soil disturbance is subsiding; the rank weeds are being subdued by the invasion of more permanent pioneers, Kentucky bluegrass and other lawn grasses. Compare the size of foxtail grass, lesser ragweed and others here with those along the raw shores. If left unmowed, bluegrass can in turn be invaded by forest.

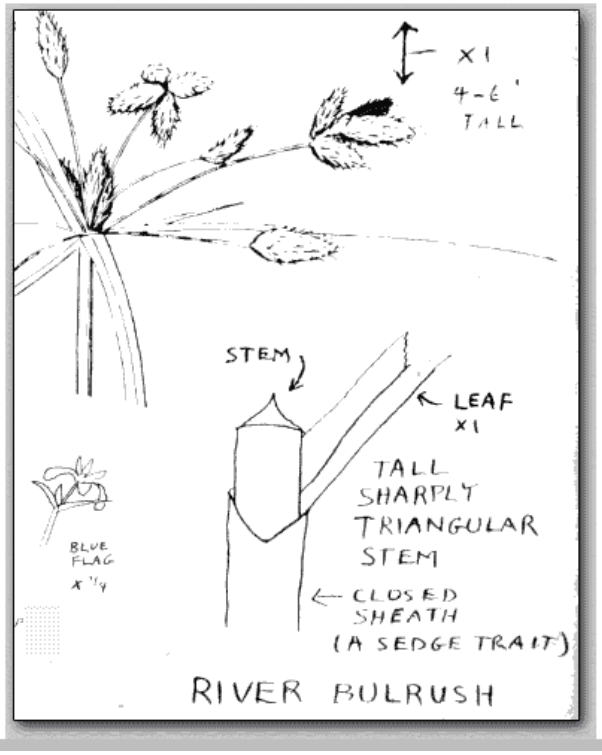


The three dominant emergents in the deep water marsh are cattail and roundstem and river bulrushes. Here roundstem predominates at present.

In moist ground (the low meadow), the dominants are bluejoint grass and tussock sedge, often now replaced by the huskier Eurasian reed canary - planted by farmers - which excludes other life. A dozen other plants of shores, mud and shallows are shown here. All the marsh plants pioneer early but many persist and spread for many years - hence can be considered "climax" vegetation.



## Sign 3 - WHAT IS A WET MARSH?

We are not talking about a pond (open water), nor a swamp (lowland forest), nor a wet sedge meadow (dry marsh, wet only in spring), nor a bog (a floating complex of acid peat moss with tamarack trees).

We mean the region of gradual transition between land and deep water--the more gradual the better, and the more irregular, the better. Gradual shallow shores, interrupted by islands caused by an uneven bottom and by muskrat houses, create an ever-changing pattern of shallows and deeps which continually renews life, yet concurrently maintains all stages of marsh development and wildlife. Diversity is greatest because no plant or animal becomes a too-abundant pest.

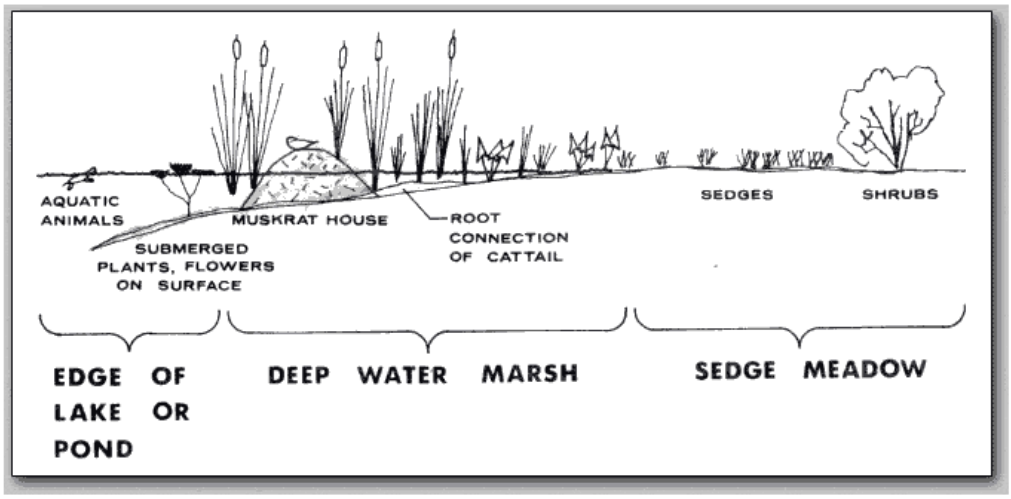
Diversity is also greatest because a variety of animals and plants can live in these ever-changing shallows, the environment closest to the shallow seas where life began on earth some 3 billion years ago. This tiny example will exhibit most of the species found in shallow and deep freshwater marshes, and some of those of the pond and sedge meadow as well.

Maintaining a healthy marsh depends on natural gradual cycles involving water levels, muskrats, and vegetation. The normal summer low permits annuals like arrowhead, smartweeds and bur-marigolds to grow and feed birds, and, exposes mud for feeding migrant shorebirds, but comes too late to let coons reach the June nests. The normal high of fall through spring attracts migrant waterfowl, permits safe wintering of frogs, turtles, fish and muskrats, and encourages breeding of plankton, frogs, and birds in the spring.

Over the years, climatic cycles cause important lows and highs also. Emergents like cattail may get too dense unless flooded out in high years or killed by "highs" of muskrats; but then they cannot restart except in occasional summers of very low water. Muskrats may not eat enough openings in the cattail if winterkills, mink or trapping reduce their numbers too much. Then the cattails may get so dense as to favor too many muskrats, causing an "eat out", which only a dry summer can restore.

Careful management of water levels here may prevent extremes of water depth, cattails, or muskrats; but timely moderate gradual fluctuations are healthy. The survival of each species depends on the improved adaptation made possible by continual replacement in each population of individuals.

Can you see a muskrat house from where you stand?



## Sign 4 - MARSH MANAGEMENT

The pump house remains from farming days (see sign 6), because water level management is still needed. Since the present fields and marsh and Nielsen Stadium are below lake level, the pump must continue to operate. This pump gives us an ideal tool for maintaining a healthy marsh under urban conditions and demonstrating how to prevent man-made nuisance problems such as: wide water level fluctuations, weeds, mosquitoes, mud E turbidity, eutrophication, and the accompanying anoxia.

**Water levels:** Maintaining a healthy marsh here involves simulating the gradual seasonal water level cycles of natural wetlands in rural areas. Because urbanization prevents water storage in soil by encouraging storm runoff, the pump may be needed to dispose of flash floods that would destroy plants and bird nests. Between rains, water may have to be siphoned in from the lake to keep the water level from dropping too much, now that many springs and seeps are dry. Managing the emergent plants and muskrats to maintain interspersion of waterways and vegetation may likewise be achieved by skillful control of water level fluctuations.

**Weeds** and trees on shores are a consequence of soil disturbance. Constructing natural shallow shorelines will prevent wave and ice action from causing undercutting or slumping of shores so that natural plant succession will stabilize the vegetation. Here we will remove persistent noxious weeds and invading pioneer trees and shrubs that got started during construction. There should be a good diversity of shore plants but no trees or shrubs. Cessation of construction in the watershed will eventually stop the addition of mud which favors undesired pioneer plants; a slight spring rise in water, to cover exposed mud, can in the meantime prevent their establishment.

**Mosquitoes** require two conditions: rapidly fluctuating water levels and absence of predators. The eggs, laid below the high water mark, require both freezing and drying before they will hatch, and the wrigglers need only two weeks of continuous shallow water or moist mud to develop. They are eaten by many predatory animals from small insects to fish. Hence most problem mosquito areas are not the permanently wet marshes but rather the river flood plain forests and the sedge meadows where an alternation of flooding and drying triggers hatching but prevents the longer-lived aquatic predators from living there. In this marsh, gradual shallow edges harboring diverse animal life, coupled with attempts to maintain water levels evenly through a very gradual seasonal cycle, should keep mosquito populations to a minimum.

**Turbidity** -- muddy water -- clogs the gills of fish and some aquatic insects, prevents light penetration necessary for plant growth and oxygen production, keeps ducks and other animals from finding food, and hence also might favor mosquitoes. Prevention of soil erosion in the watershed and on the shores, and keeping carp out, should lead to clear water. Unlike clay and silt, the organic matter accumulating on the marsh bottom does not stay in suspension for long when stirred up. Until the bottom becomes organic, the marsh could be temporarily pumped dry in late summer to settle the mud if it won't settle by itself. The silty water could be pumped onto the grassy playing field, which could absorb the silt as well as the fertilizer in the water.

(For **Eutrophication** and its abatement, see Sign 7)

## Sign 5 (16) - AQUATIC INSECTS AND OTHER INVERTEBRATES

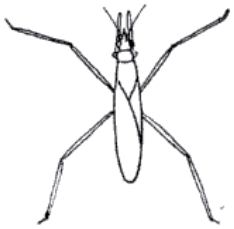
At this point you can closely examine the mud, plants, air and water for small insect life. The emergent plants are cattails, bulrushes, and water plantains. On the surface there may be a layer of green duckweeds (not the same as a scum of nuisance algae -- see sign 30). When not covered by plants, the water is usually clear enough near this outlet to view small animals swimming in the water. When not overtaxed, the marsh can help clean up muddy or over-fertilized water. At the main inlet (sign 16), the water may be muddier.

**Beetles** - Hard smooth outer wings meet in straight line; Jaws; J Water (Large & small worm-like swimming larvae; some large and small streamlined adults take a silvery bubble of air with them under water). On Water (Silvery convex Whirligigs). Above Water (Golden beetles, fireflies, Ladybird beetles).

**Bugs** - Hard or soft; hive slender proboscis; no larval form: In Water (Large and small streamlined adults; the water boatmen hive a pair of oar-like legs and come up for air at intervals). On Water (Waterstriders (long legged); also tiny bugs running on duckweed). Above Water (Tiny plant lice and leafhoppers; several larger bugs have wings crossed over on back).

**Flies** - Large eyes and only 2 wings; while bees have smaller eyes & 4 wings: In Water (Many small worm-like and wriggling forms in water, mud and plant stems. Some come up for air). On Water (Tiny flies running on duckweed; midges leave floating pupil cases). Above Water (Deer flies, Hover flies, Assassin flies, Mosquitoes, Midges).


WHIRLIGIG BEETLE


WATER STRIDER

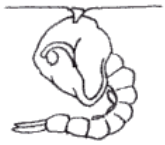

BACKSWIMMER

**Dragonflies and Damselflies** - Slender; see sign 15: In Water (Ferocious "nymphs", lurking in waterweeds or under debris, up to 1" long). On Water (Emerging adults leave nymph skeletons clinging to stems). Above Water (Flying adults of many colors and sizes).

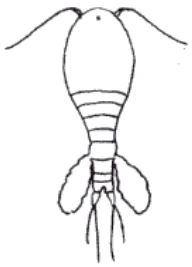
**Caddisflies** - Adults moth-like, nocturnal with long antennae: In Water (Small larvae make tubular houses of plant matter or stones, crawl on bottom or on plants). Above Water (Small, nocturnal, with long antennae).

**Snails** - Several types glide along on plants or underside of water; they feed extensively on plants and debris.

**Leeches** - Flit, Worm-like, attached to plants or swimming like snakes; mostly parasitize frogs and turtles.


MOSQUITO PUPA


CADDIS FLY LARVA IN CASE


COPEPOD WITH EGGS

**Clams** - Small or large, in mud; young may attach to fish when very small.

**Spiders** - Wolf and fishing spiders on surface; crab spiders, beautiful orb weavers and others on emergent plants, especially toward fill.

**Crustaceans**

- Water fleas, copepods, seed shrimps, etc. in water - tiny swimming specks, often very abundant, mostly 1/32-1/4 inch long.
- Scud shrimp in water - about 1/4 inch long - scoot about when disturbed.
- Crayfish near or on shore; some build chimneys in shore mud.

Most of these groups of invertebrates include both plant-feeders and animal-eaters. The larger ones in turn feed fish, frogs, birds and raccoons. Hidden from view is a still more varied world of plants and animals requiring a microscope with 100X – 450X magnification: The Plankton.

## Sign 6 - HISTORY OF THIS MARSH

This entire nearly level basin (some 80 acres) was once filled with peat. It is bounded on the west and north by University Bay Drive, and on the southeast by the Natatorium and Marsh Creek. On the south it once graded up into prairies and fields about where Marsh Lane is now.

Peat accumulates where waterlogging prevents access of oxygen so that bacteria cannot feed on plant remains. Kept wet by runoff and springs, the basin had been a soggy area for over 10,000 years, although it was sometimes above the level of Lake Mendota. As the last glacier retreated, damming the Yahara Valley with deposits of mud and gravel, this basin was probably a bay of the lake at a high-level stage. Study may show that the first peat to be laid down was of sphagnum and wiregrass sedge, containing pollen of spruce and fir; for most of our peat deposits began as floating bogs like those of bays in our present northern lakes.

The lake may have backed up to higher levels at more recent times because of dense vegetation and beaver dams at the outlet; but around the turn of the century, it was getting lower because of erosion of the outlet. This basin was probably a sedge meadow then. In 1912, the Tenney Park Locks were installed, raising the lake above the level of this peaty basin.

To put the peat meadow to use, a leaf was taken from the thrifty Dutch: tile the fields, build a dike and use a pump. The filled dike, built on an ice-push-up-ridge, became University Bay Drive; the faithful pump in the metal shed nearby continually removed seepage coming from the peaty field and from the lake for over 50 years. A sign on the pumphouse explained this pilot land reclamation project. With proper fertilizer, the peat field yielded excellent crops of corn. Unfortunately, not all lowlands had a lake to protect them from summer frost damage; so following the University's advice to drain and farm the lowlands did not always meet with such success elsewhere.

Farming had increased wildlife abundance because the field provided abundant food - both waste corn and the weeds perpetuated by soil disturbance. Shorebirds, ducks and geese that circled the lake would drop in at the field in spectacular numbers. The adjacent and slowly encroaching weedy University Dump (now Lot 60) and the marshy ditches helped also, and together they attracted bird watchers from far and wide to see rarities like pipits, snow buntings, snow and blue geese, phalaropes, white crowned and Harris' sparrows, and short-eared owls. Pheasants thrived on the corn also.

Wildlife use intensified in 1967 when progressive oxidation of the drained peat deposit had finally caused the deeply-laid drain tiles to appear on the surface, interfering with plowing and harvesting machinery. The pump was turned off, and the flooded ripening crop of corn was soon discovered by all of Madison's mallards and teal, which began commuting daily over the city. One could stand at Lot 60 and see hundreds of mallards descend from the sky at sunset. Still more migrating waterfowl came in from the lake that fall, and in the spring of 1968, many water birds stayed to nest as the 30-acre flooded field began to provide water plants for cover. This became the spot to see, with ease, beauties like green-winged teal, ruddy and shoveller ducks, and the elusive gallinules and rails of the deep water marsh.

Argument arose over the use of the land, which was avidly sought for parking space and athletic fields, as well as for wildlife habitat accessible to biology classes and nature-lovers. The present compromise divides this land between these three uses. To some extent they overlap, since parking makes the area accessible to more wildlife viewers for recreation, and the playing fields, when not in use, provide quiet buffering open space around the present small marsh for the flying, feeding and roosting needs of birds.

## Sign 7 - EUTROPHICATION

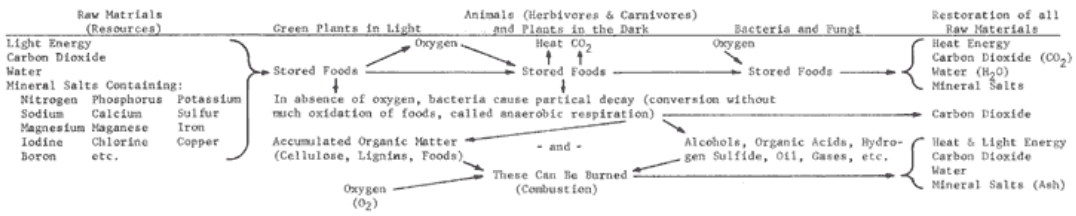
Eutrophication is a major problem in lakes and marshes today. The undesirable overgrowth of over-fertilized algae and waterweeds often result from increased storm runoff from farms and cities. The ditches and storm sewers carry lawn and farm fertilizer, dog excrement, farm manure, fertile eroded topsoil and sometimes septic tank overflow, including phosphate detergents. Sometimes, too, there are canning and dairy product wastes and municipal sewage which, even when treated, still contains abundant fertilizers. Phosphorus, the essential mineral that is the hardest for plants to get in sufficient quantity, is present in all these sources.

The overgrowth of plants in itself is not bad; in fact it could increase wetland productivity, but two results offset this benefit. (1) Plant diversity declines. For example, one nuisance waterweed, European milfoil, has almost completely replaced some 50 kinds of waterweeds in University Bay since 1910, with a corresponding reduction in animal variety. On the microscopic level, a few nuisance blue-green algae often replace a wide variety of greens, in Lake Mendota and other over-fertilized waters, and serve as indicators of this condition. (2) Overgrowth overtaxes the oxygen supply. Water plants begin to clog boat lanes; algae-filled pea soup water or green or brown scums become unappealing to swimmers; and summer fish kills eventually result from anoxia in warm water (which stores less oxygen) wherein bacteria become especially active. Bacterial decay of this accumulating waste of dead plants and animals steals more and more oxygen, so that bad odors, oil slicks, and even poisons are produced as bacteria shift over to anaerobic respiration (see diagram below).

What to do? Chemical weed control does not get at the cause (does not remove minerals from the system), and may harm desirable life. The first step is to prevent further fertilization from outside. The surrounding playing fields should not receive lawn fertilizer, nor even the herbicides that can, in very low concentrations, actually stimulate plant growth in the marsh. Second, once the sources of phosphates and other fertilizers are cut off, the waters and muds must be made less fertile since the minerals are stored and recycled there as plants grow and decay, Repeated harvest of water plants would help; an organic fertilizer might be made from dried waterweeds and algae. Direct chemical extraction from water might be quicker but at present is expensive. The third method, natural filtration and extraction of mineral salts by soil, sod and upland vegetation, could be attempted here experimentally. This marsh's fertile water could be pumped out to irrigate and fertilize the grass of the playing fields in the summer. The somewhat less fertile lake water could be brought in to replace what does not run back overland or seep back underground.

Anoxia can occur in winter, too, when heavy snow cuts off light from the plants beneath the ice for too long. Fish will also winterkill in shallow water that freezes to the bottom. The mud settling here has made the water shallow and killed even the hardier frogs, turtles and dragonflies. Hence fish stocking will not be attempted at present. If fish appear here, we can study the human and natural causes of fish dispersal!

### RECYCLING IN NATURE IS COMPLETE IF OXIDATION IS COMPLETE



## Sign 8 (29) - BIRDS OF MARSH EDGES

In addition to the shore and water birds (signs 9/24, 10/23, 11/25 - 28-31), marshes are home for many birds which use either open meadows & fields, the annual weeds, or the shrubs for food and sometimes nests or cover.

**I. OPEN MEADOWS** - In abrupt transition from mowed upland fields to wet marsh, most OPEN SEDGE MEADOW birds may be absent here: snipe, marsh hawks, bobolinks, short-eared owls, short-billed marsh wrens. But horned larks and Killdeer may nest on the grassy edges.

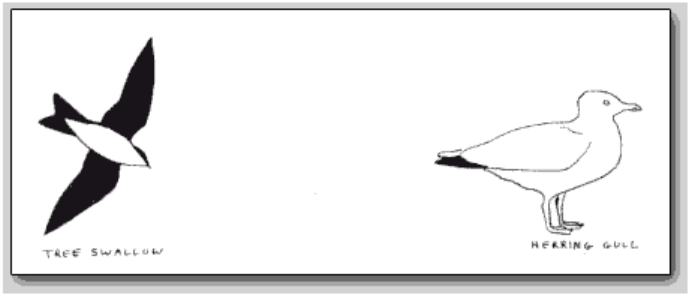
**II. SHRUBS** - Shrubs and trees, both natural and planted, include:

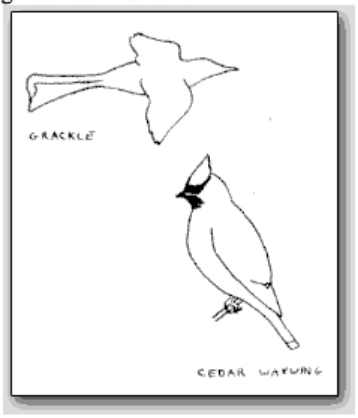
- **Lowland Species**:

  red-osier dogwood — American black willow — tamarack (of bogs)
  pussywillows — European golden willow — river birch (of Wis. River)

- **Upland shrubs**: The open space lovers - shadbush, hazel, choke cherry, gray dogwood, brambles, crabapples, plums. Since trees abound by the lake to harbor nesting green herons, wood ducks, woodpeckers, house wrens, and tree swallows, large trees will be kept to a minimum here to favor waterfowl and shore birds (sign 10).
- **Shrub Nesters** expected to locate here include: yellow throat (a warbler), yellow warbler, song sparrow, swamp sparrow, goldfinch, catbird, traill's flycatcher, red-winged blackbird, grackle (All are summer insect-eaters except goldfinch, which nests only in late summer when seeds become abundant).
- **Insect Feeders** in spring and fall will include wanderers and migrants (the first five also eat berries): robin, catbird, waxwing, thrasher, thrushes, phoebe (a flycatcher), palm warbler, kinglets and wrens, pheasant

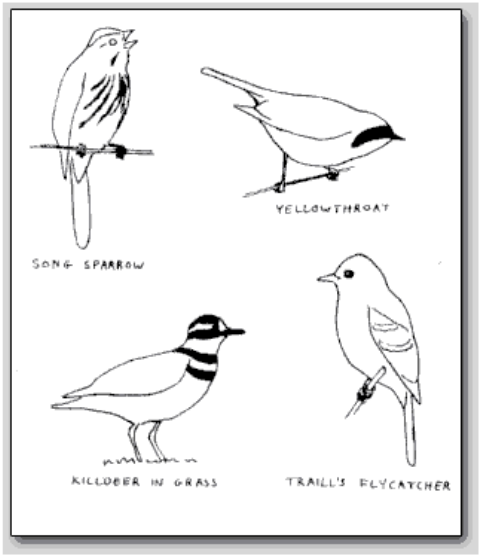
**III. ANNUAL WEEDS** - The mostly short-lived weeds include ragweeds, pigweeds, bur marigolds, docks, smartweeds, amaranth, campion, sweet clover, evening primrose, mullein, fleabane, horseweed, knotweed, wild lettuce, pepper grass, bull thistle, velvetleaf, and several grasses - barnyard, foxtail, witch and love grasses and chufa sedge. These provide seeds attractive to the fall and winter sparrows and finches and their associates (less common ones in parentheses); and Ring-necked Pheasant



**Seed Eaters:**

| | | | |
|---|---|---|---|
| horned lark | cardinal | swamp sparrow | field sparrow |
| bluejay | purple finch | fox sparrow | tree sparrow |
| white throated sparrow | gold finch | song sparrow | junco |
| chickadee | (white-crowned sparrow) | Lincoln's sparrow | (redpoll) |
| (pipit) | (Harris sparrow) | savannah sparrow | snow bunting |




## Sign 9 (24) - WILDLIFE SIGN AND HABITATS

Each place has its special animals which came there for a particular purpose. In addition to the water and marsh-edge birds you will find:

**On the trail**: Earthworm castings appear wherever soil is moist enough for survival. Mourning doves seek seeds and grit on bare ground, and you may see the scats of coon (and perhaps fox, skunk, woodchuck and dog) who follow human trails in search of food, especially at dusk and dawn. Would snakes leave any tracks or sign? Will crayfish chimneys appear on the muddy shore?

**On the open mowed fields**: gulls and crows. These scavengers like open spaces where they can spot carcasses and other food from high in the air. They also use open fields for resting and social gatherings, since enemies can be seen from afar. Crows nest singly in forests but are gregarious at times even in summer. The gulls (usually ringbilled gulls and a few herring gulls) nest on islands of the Great Lakes; but wandering non-nesting adults and immatures are seen over Madison lakes the year round. Waterfowl and shorebirds likewise will use these open fields for feeding or resting on occasion, sometimes in large numbers, as will the city's starlings and rock doves.

**In the water**, most wildlife like an interspersion of:

a. open water - for visibility, skimming, diving and take-offs - by grebes, ducks, coots, terns, kingfishers, swallows.
b. sparse emergent cattail, bulrushes, and arrowheads for hiding - by tadpoles and chicks while feeding, and by breeding frogs.
c. denser emergents for nesting and hiding - by ducks, grebes, rails, coots, bittern, gallinule, marsh wrens, redwings, grackles.
d. islands for nesting (mallards, teal, black terns) and resting sites (many birds and turtles).
e. muskrat houses, likewise used for rest sites, and for nesting by ducks and snapping turtles.

Ducks also need the protection of open water and plant cover during the brief period in summer when moulting renders them flightless. Look for feathers on the water where ducks have been preening. An interspersion of about half open water and half emergent plants is very important so that birds, muskrats, turtles, and frogs can move quickly in and out of hiding as need be. The causes of interspersion (furniture arrangement) need more attention and application in wildlife habitat rehabilitation.

**In the air**, many food-seeking visitors to the marsh may be seen along with maneuvering squadrons of ducks and shorebirds:

a. from the city - nighthawks, chimney swifts and purple martin
b. from cliffs and banks - kingfishers* and swallows - bank, roughwinged and cliff.
c. from hollow trees - tree swallows.
d. from bridges and buildings - barn swallows (some may nest under our bridges here).
e. from marshes and lakes - black terns* (may nest here), forster's and common terns*, ringbilled and herring gulls*.
f. from the forest - cedar waxwings.

*Seeking fish. The rest seek flying insects.

## Sign 10 (23, 32) - OPEN GRADUAL SHORES AND WATER CYCLES FOR PRAIRIE AND ARCTIC BIRDS

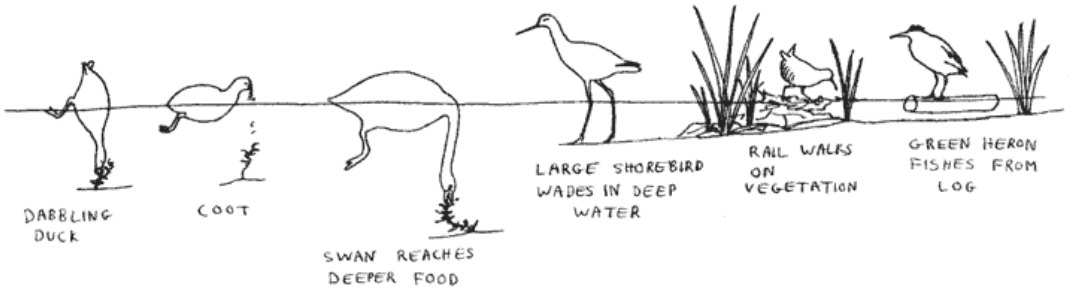
Birds of open country (prairies and tundra) do not like to have their horizons hemmed in by trees, hence the scarcity of large trees in the plantings along this trail. Gradual shorelines are equally vital to these birds because they provide the plants and small animals of shores and shallows used as food.

**WATERFOWL:** Ducks, geese, coots and grebes like open edges for flight lanes, for ease of take off, and for observing their enemies. Watch the ducks coming or leaving to see how they circle about and settle in large geometric patterns which require almost all of the treeless playing field space. Natural gradual lowering of the water level in summer favors the growth along gradual shores and on old rat houses of smartweeds and water plants on which ducks feed. Shallow water allows ducks to dabble on the bottom for waterweeds, clams, and dragonfly nymphs.

**SHOREBIRDS:** Sandpipers and plovers, likewise gregarious flocking species, need similar open space for their exquisite maneuverings as all members of the flock turn suddenly, with precise timing, this way and that, faster than blackbirds and far faster than ducks or geese, Small water level changes expose shallows and mud flats for feeding on seeds or insects by these wading birds. But only a very gradual slope on the shoreline will have a wide enough band of mud and shallow water to satisfy the shorebirds. We may have to modify the grades further as well as mow the ranker upland weeds in places to satisfy them. Shallower grades will promote low marsh vegetation and hinder invasion of the edges by shrubs or tall weeds.

Two shorebirds - killdeer and spotted sandpiper - nest locally as well as feed on mud flats, sand, gravel, meadows, and fields. A succession of yellowlegs, dunlins, dowitchers, curlews, godwits, phalaropes and many others can be expected to stop briefly on their way to and from the Arctic.

Caution: To see ducks and shorebirds always look far ahead as you stroll quietly along. Pause frequently and scan the marsh. When you spot birds, stalk them with great care so as to get closer without flushing them.



## Sign 11 (25, 28, 31) - OBSERVING MARSH BIRDS

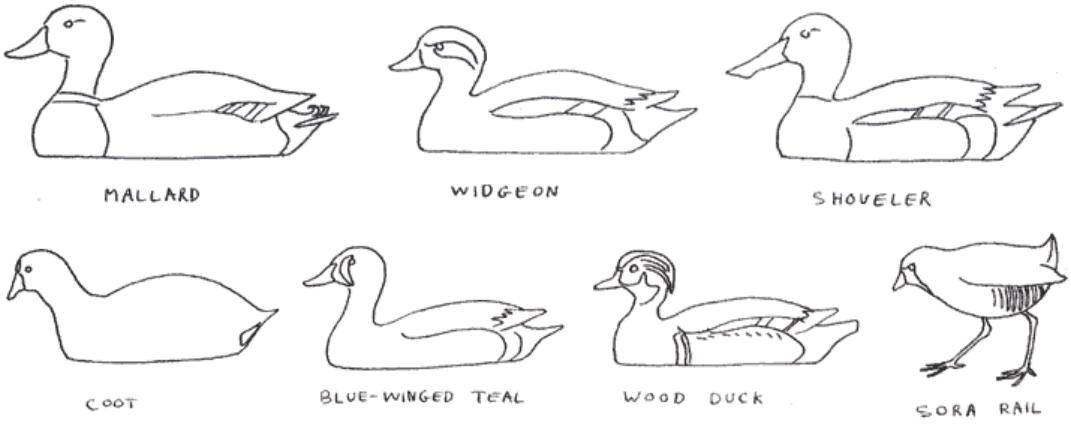
Approach cautiously, looking far ahead as well as nearby, moving slowly. Stop for long periods, watching carefully for movement among the vegetation in the water. Fast motions, bright colors, or loud talking will flush birds into the air or into dense cover. But with experience you can stalk any bird, with or without binoculars, and observe its natural behavior.


Water birds likely to be seen here include the following: *Locally nesting species starred. See also signs 8 (29) and 10 (23) for other marsh birds.

**Ducks:** Mallard*, Blue-winged teal*, Wood duck*, Green-winged teal, Shoveler, Scaup, Ringneck, Redhead, Widgeon, Gadwall, Ruddy, Pintail.

**Others:** Coot*, Gallinule*, Pied-billed grebe*; Sora*, Virginia*, and King* Rails; Long-billed marsh wren*; Redwing* and Grackle*; Black tern*; Green heron*; occasionally other herons, egrets, and bitterns.

*Locally nesting species starred.



## Sign 12 - AMPHIBIANS, REPTILES AND FISH

Although siltation and freeze-outs in shallow water may deter these animals at present, we hope the following marsh animals will eventually breed here.

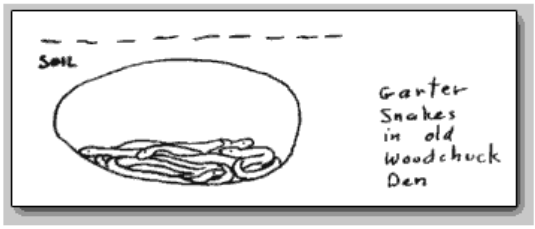
**Frogs and toads** are the voices of spring and a major food of herons, bitterns, terns and kingfishers. As aquatic tadpoles, they eat plants; then they become insect-eaters on land. The most abundant amphibians to be heard in spring, in order of appearance are:

1. **Chorus frog** - a tiny striped sprite with a loud voice, which sounds like running a finger over a comb. Often called spring peeper, but the true peepers (which whistle) prefer wooded edges such as at the pond on the north side of Picnic Point. Both tiny frogs mature in one year, reaching a length of one inch.
2. **Leopard frog** - the common medium sized green, dark-spotted grass frog with two light colored ridges down each side of the back. Voice: a long snore and several growls.
3. **American toad** - the abundant warty creatures that give long trills. Long strings of eggs produce numerous tadpoles and toadlets before fall. May be found a mile from water.


Other amphibians you might hear in this area: spring peeper, cricket frog, tree toad, and green frog. Tiger salamanders may also come here to breed.

**Frogs** sing to cause males and females of the same species to assemble in suitable places for efficient breeding. Males mount the females, grasping them to squeeze out the eggs, which are fertilized in the water. Rain (or rise in water level), increase in temperature, and onset of night - individually or in combination - stimulate frogs to call and mate. Frogs need shallow gradual vegetated edges in which to breed, mate and feed safely, so that birds don't find all of them.


**Reptiles:** Breed on land but often feed in the water, just the reverse of the amphibian way of life. Garter snakes and several large and small upland snakes may feed on frogs and birds' eggs in the marsh. They hibernate in upland dens. Turtles are more aquatic, feeding on plants and small animals in the water and hibernating in the mud, like frogs; but they too lay their eggs out of the water. Snapping turtles may lay in wet decaying vegetation such as rat houses, or in moist soil on shore. The abundant red-bellied painted mud turtle and the rarer spotted Blanding's turtle must travel to dry sandy hillsides, carrying a supply of water so that the eggs can be wetted down when buried, Young painted turtles remain in the ground after hatching, traveling to water in the second year.




**Fish** can survive if water doesn't freeze to the bottom, and not too much of organic matter is decaying in the summer. Marsh fish may include several minnows, sticklebacks, small sunfish, bullheads, sometimes catfish and the introduced carp. Future marsh management may provide more fish, amphibian: and reptile habitats.

## Sign 13 - THE SOUTH KNOLL - SAND FOR PRAIRIE AND TURTLES

Originally thought of as observation points, the knolls or mounds probably will serve better as protective barriers to give marsh wildlife some privacy from people. Ducks are likely to fly up if you climb up and appear silhouetted against the horizon. Please stay on the trail!

So, the knolls are not to be walked over. On this knoll, a sand layer was laid for several purposes. It may attract birds seeking grit or dust baths. But it will also serve two experimental purposes - turtle breeding sites and prairie restoration.

Painted and Blanding's turtles, and various snakes, are dependent on dry places where eggs can be laid. Vehicular traffic takes a heavy toll of turtles and snakes on their way between breeding sites or winter dens, and the lowlands where they feed. Providing an immediately accessible area of dry soil, where holes are easily dug, may be of great importance in increasing the breeding success and survival of these turtles and other reptiles. Lack of mowing and trampling will also contribute to survival of the young after hatching, since they may be unable to crawl out if the soil becomes hard packed.

The ideal vegetation cover for dry and poor soils is the original prairie sod (see Sign 20). This drought-adapted vegetation with its many beautiful flowers was the dominant upland flora at Madison in 1840 as a result of earlier droughts and fires that had pushed back the forest.

Now, in our present moist forest climate, it is difficult to re-establish the slow-growing, deep-rooted prairie plants because the quick-growing weeds (Sign 22) overpower them in a few weeks before they can attain full size. Therefore, adding a layer of sterile dry sand may be of use in hindering the weeds. Once established, the prairie plants will enrich the sand with organic matter; but, by then, they will be thick enough to keep out both the weeds and the forest. If the sand layer technique succeeds, it may be useful in prairie re-establishment elsewhere.

The prairie grasses provide better cover for mice, rabbits and birds than does the exotic old field cover - bluegrass, redtop, reed canary, timothy, quack, smooth brome, and sweet clover; yet harbors no nuisance weeds. Prairie grasses can be left alone or, as desired, be burned or mowed to control height and growth. Since they grow shoots only once a year (midsummer), control is simple.

The construction of dry mounds of soil may attract several mammals which seek places for easy digging, adding many future interactions to the ecosystem. Moles and skunks may find the soil suitable for extensive tunneling in search of insects and roots, laying bare soil for dust baths and grit for birds and local weed perpetuation for bird seed. Local ground squirrels may move in and establish a "town" as did the prairie dog farther west. Woodchucks might dig dens later used by snakes, skunks, mink, foxes and badgers. The mink would prey on muskrats and nesting birds' eggs, while the fox and badger would control the ground squirrels as well as rabbits and mice. More hawks might move into the wooded areas to eat the snakes and rodents.

## Sign 14 - SOIL TYPES AND PLANT INFLUENCES

Soils vary greatly and reflect the influence of both geology and vegetation.

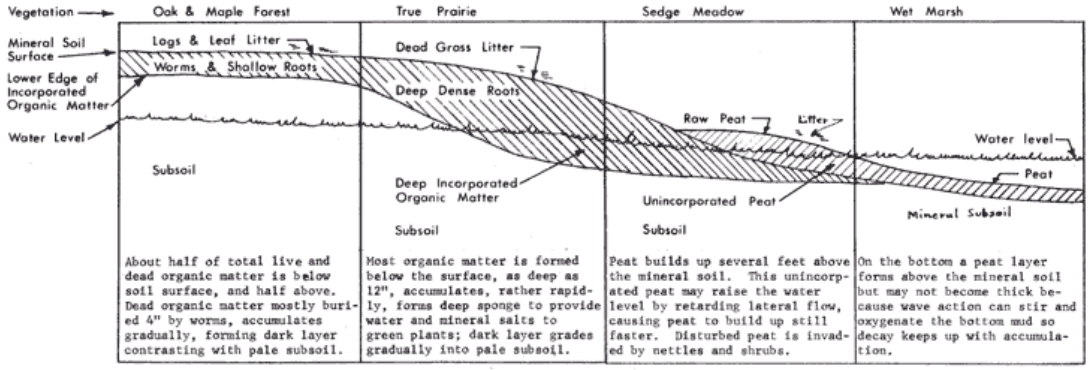
**TEXTURE** - may be "light" or "heavy": Feel a piece of soil between the finger tips. If it is gritty, large particles (sand grains) are present. A high sand content means low fertility and low moisture retention, but good aeration and rain penetration and easy working even when wet or cold (hence called light soil).

If it feels pasty, smooth, and soon dries your skin, it has a high clay content (very small mineral particles). Clay has a high attraction for and retention of water (will even steal it from your skin) and of minerals (fertilizer). But too much clay means low aeration, and clay disturbed or trampled when wet or cold may become hard. Such "puddled" soil has lost what pores it had for air and water and root penetration.

**ORGANIC CONTENT** - A dark layer indicates plant influences. If the soil is dark, light in weight, and moist but crumbly (does not dry the skin), it has a very high organic content and is called peat. Peat soils build up in sedge meadows (and in the cold floating moss bogs of the north) because waterlogging prevents aeration, retarding bacterial decay of plant matter (just as cold climate can). Peat has high retention of water and fertilizer, gives good aeration if well drained, and high absorption of rain if not too dry, but may be deficient in some available minerals. Disturbed peat has, in addition to ordinary weeds, special ones like marsh nettles and giant ragweed.

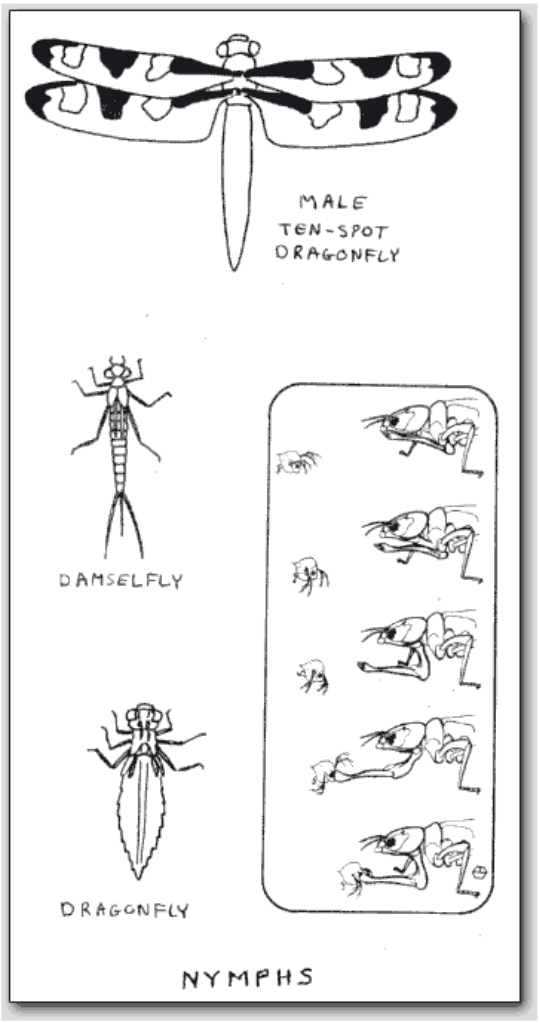
A good loam soil has an organized structure of coarse and fine mineral matter and some organic matter too. The glaciers left us good loams in Dane County, which the prairies enriched further with deep organic incorporation. Some of the soil here is topsoil (loam) brought in from farmland. In other places, there is almost pure peat, because this marsh was once a waterlogged sedge meadow (see sign 6). The presence of nettles and dark soil color will indicate the peat. The south knoll (sign 13) has a top layer of coarse sand brought in to increase dryness.

**Diagrams** of organic layers in some natural soils. (The soils you see here were disturbed by construction and the bringing in of fill, but can still be tested for texture and organic content).



## Sign 15 - DRAGONFLIES - INSECT AMPHIBIANS

Back in the Coal Age, nearly 300 million years ago, amphibians had already appeared: Vertebrates that evolved from fishes, able to breathe and crawl on land, but returning to the water to breed. More remarkable, perhaps, were another group also present in the Carboniferous Era, the dragonflies. Remarkable because in their insect ancestry they had become completely air-breathing, land-breeding animals, only to return later to the water to develop an aquatic larval stage complete with gills.



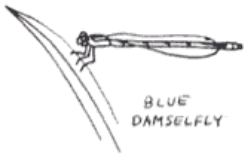

The submerged larva or "nymph" of dragon and damselflies are highly predatory. It lurks camouflaged among water plants and on the bottom mud, stalking its prey like a cat. When prey is close, the front of the face opens out into a scoop-shaped structure which is suddenly thrust out and back, seizing the insect (or small fish) in an instant. Jet-propulsion (expelling water from the abdominal gill chamber) aids them in escape. If not eaten by a duck (or by another voracious dragon "nymph"), the nymphs climb out (after doing a 1 - 3 year stretch in the water) onto an emergent plant, split down the back, pump up their new wings and dry in the sun. Then they spend a summer - or probably two - expertly flying about to defend territory and capture flying insects. While flying in tandem, a pair will mate and sometimes continue flying together during egg-laying, making passes close to the water. They rest at night on dewy grass. The big green darners with clear wings may migrate south for the winter and live perhaps another summer.

Damselflies are more delicate, fly slowly, and hold their wings together over the back when at rest. In contrast, the stout, fast dragonflies hold the wings out at right angles to the body when perched, and the degree to which the wings are lowered indicates how deep the rest is. In most species the males are brighter than the female. A common damsel has a bright blue body (female paler). The common marsh dragonflies come in three main groups (not all to be seen here unless siltation can be controlled):

Dragonflies

Small; wings clear
male: red body
female: brown body


Medium; spotted wings
male: white and black spots on wings
female: black spots only
other kinds differ in body colors and spots



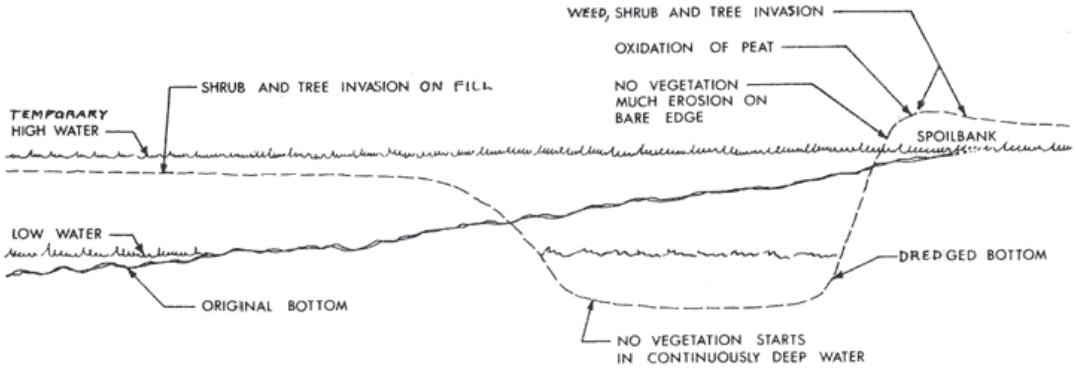

Large (darners); wings clear
sexes similar
body green and blue

No sign 16

## Sign 17 - WHY A DITCH IS NOT A MARSH

Waterways are often deepened for boat access or drainage, but the marsh and its abundant life is destroyed in the process. Not only are large areas of shallows filled with dredgings, but the actual shoreline becomes abrupt. The results of ditch-dredging in the wetlands are:

1. Little change in land or water area as water levels change, providing no shallows for marsh plant establishment (cattails, smartweeds) nor for feeding by birds (ducks, shorebirds, herons).
2. No habitat for much of the abundant small forms of life of the shallows, from frogs down to microscopic plants and animals.
3. Wave and ice action that perpetuate the abrupt drop-off through erosion, until the bottom is filled and the dredging is repeated. Erosion and animal action perpetuates muddy water. Bare soilbank and erosion faces may become colonized by weed pests including nettles and shrubs and trees, which may not stop erosion, while they can stop waterfowl use.
4. Eutrophication of the water as a result of oxidation of any organic spoils dumped above the water level, because of the rapid release of soluble minerals from decaying peat.




No sign 18, 19

## Sign 20 - PRAIRIE RESTORATION

As noted in Sign 13, "The ideal vegetation cover for dry and poor soils is the original prairie sod. This drought-adapted vegetation with its many beautiful flowers was the dominant upland flora at Madison in 1840 as a result of earlier droughts and fires that had pushed back the forest.

Now, in our present moist forest climate, it is difficult to re-establish the slow-growing, deep-rooted prairie plants because the quick-growing weeds (Sign 22) overpower them in a few weeks before they can attain full size. Therefore, adding a layer of sterile dry sand may be of use in hindering the weeds. Once established, the prairie plants will enrich the sand with organic matter; but, by then, they will be thick enough to keep out both the weeds and the forest. If the sand layer technique succeeds, it may be useful in prairie re-establishment elsewhere.

The prairie grasses provide better cover for mice, rabbits and birds than does the exotic old-field cover - bluegrass, redtop, reed canary, timothy, quack, smooth brome, and sweet clover; yet harbors no nuisance weeds. Prairie grasses can be left alone or, as desired, be burned or mowed to control height and growth, since they grow shoots only once a year (midsummer)."

Here, prairie establishment is being attempted by plowing and seeding followed by selective summer mowing of the rank weeds. Time will tell if this technique is successful in giving the permanent prairie plants a chance to grow large enough to occupy the site completely, thus preventing further invasion of weeds.

Prairies can be distinguished from the common (mostly Eurasian) weeds of old fields and roadsides by their characteristic plants. For more information on prairies, see the U.W. Arboretum's "Guide to Prairies", 1971, or visit the Arboretum.

**Prairie Plants**

| | | |
|---|---|---|
| Big bluestem grass | Rattlesnake master | Lead plant |
| Little bluestem grass | Cone flower | Prairie clover |
| Indian grass | Gayfeather | Rosinweed |
| Switch grass | Prairie thistle | Rough goldenrod |
| Cord grass | New Jersey Tea | Compass plant |

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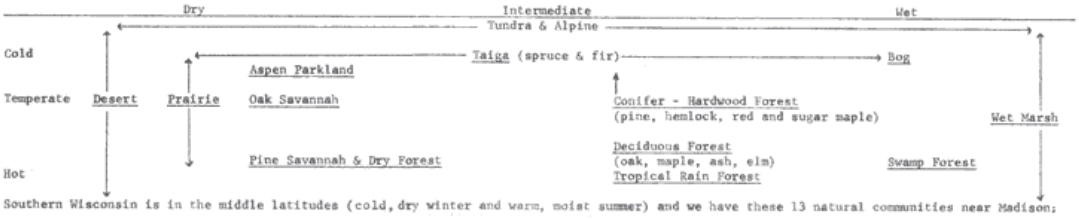
**Old Field Plants**

| | | |
|---|---|---|
| Canada bluegrass | Parsnip | White Dutch clover |
| Kentucky bluegrass | Chicory | Sweet clover |
| Smooth brome grass | Mullein | Goatsbeard |
| Timothy grass | Bull thistle | Common goldenrod |
| Redtop grass | Sow thistle | Bergamot |

## Sign 21 - VEGETATION TYPES

Natural vegetation occurs in distinct types adapted over time to specific environments. Various vegetations can influence the soil quite differently as noted in sign 14. The major types (Life Zones) are:




**Forest**

**Oak (dry) Forest*** (everywhere) Bur-Black-White-Red oaks, Black cherry, Shagbark hickory

**Climax (mesic) Hardwood** (Eagle Heights, Maple Bluff) Sugar maple, Basswood, Elm, White ash

**River Swamp** (Yahara and Wisconsin river) Silver maple, Elm, Green ash, Swamp oak, Willow, Hackberry

**Shrub***

**Old Field** (Arboretum, Eagle Heights) Bluegrass with invading oak forest shrubs and saplings

**Wet Meadow** (drained or silted) (Arboretum, Cherokee) pussywillows, Red osier dogwood

**Dredged Ditch-Bank & Shores** (here, Arboretum, farmlands) Willows, Boxelder, Elm, Cottonwoods, Green ash

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**Open-Dry**

**Short-lived Weeds** (everywhere; croplands; here; see signs 8, 22)

**Old Field, Pasture, Roadsides, Lawns** (everywhere) see sign 2. Bluegrasses and other Eurasian and American long-lived weeds

**Prairie** (Arboretum restorations; see signs 13, 20) relics; holds own especially with fire, but goes to old field if disturbed

**Sand Barrens** (Wisconsin River and Arboretum) (some desert and prairie species)

**Open-Wet**

**Deep Marsh** (here and by Picnic Point; see signs 2, 3, 30) Cattails, Bulrushes

**Wet Meadow** (Arboretum and Cherokee) Tussock sedge and Bluejoint grass. If water rises, goes to cattail; if siltation occurs, goes to ragweed

**Lowland Weeds** (disturbed or drained wetland) (Arboretum, farms, spoilbanks), Nettle, Giant ragweed

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*All three shrub communities and the oak woods are being invaded by dense masses of Eurasian honeysuckles and buckthorns that gained entry with livestock grazing. See sign 8 (29) for some common native shrubs.

Settlement has caused a great expansion of the weed floras, both native and introduced (150 kinds), and the elimination of many native floras (some 2,000 kinds), especially the prairie (320 kinds), removed either by plow and cow, bulldozer and herbicides, or by forest invasion if left unburned. Upland erosion, siltation in the deep marshes, and drainage and grazing in wet meadows have allowed invasion of all by shrubs, along with the Oak forests which are slowly changing to maple with fire protection.

## Sign 22 (27) - WEEDS, WETLANDS, WILDLIFE AND MAN

A **WEED** to the gardener, firmer or forester is a plant unusable or unwanted where it grows - corn in a rose patch, orchids in the cranberry bog, "worthless" boxelder, beech or hemlock in the logging forest. Unfamiliar plants of waysides, fields, woods or wetlands are "weeds" to most people until properly introduced as interesting or valuable personalities. Submerged water plants are also called weeds (see sign 30). But to the ecologist, weeds are a specialized group adapted for taking advantage of temporary removal of permanent vegetation by fire, flood, erosion, animal diggings or man's activities. Soil disturbance triggers their germination, and they grow rapidly, making full use of the abundant light, minerals and moisture. They produce prodigious numbers of mostly long-lived seeds. The plants are usually short-lived and cannot tolerate competition. The next generation succumbs to its own crowding if not the returning slower-growing permanent vegetation. Half are Eurasian, the rest American. Today the ecological weeds fall into two groups - "Bad and Good":

1. **Wild weeds** perpetuated by natural or man-made soil disturbances and mostly not used directly by man; hence a nuisance: ragweeds (main cause of late summer hay fever), smartweeds, pigweeds, cocklebur, burdock, certain thistles, witch and foxtail and barnyard grasses, and 150 more. These have great wildlife value -see sign 8 (29).
2. **Domesticated weeds** now perpetuated by planting and intentional soil disturbance and bred and selected for faster and higher production, which is made possible through additional care: more fertilizer, more water, and freedom from competition by other weeds (by plowing, cultivating, wide spacing of plants): Corn, rice, wheat, oats, rye, barley, cotton, tobacco, hemp, flax, potatoes, squash, tomatoes, peas, beans, clovers, alfalfa, smooth brome, Kentucky bluegrass, winter rye, and most garden flowers both annual and perennial.

**DOG-IN-THE-MANGER WEEDS:** Both wild and cultivated weeds include some that have become permanent factors in active and abandoned farms and in most of our once-disturbed natural lands because, unlike most weeds, they are long-lived and can stand both competition and disturbance once they are established. Most of these are exotics, probably lacking some of the natural controls they had in Eurasia, as probably is the case with the invading Tatarian honeysuckle and European buckthorn shrubs in our woodlands and shores.

| | | |
|---|---|---|
| Quack grass | Timothy | Leafy spurge |
| Reed canary | Parsnip | Sow thistle |
| Kentucky bluegrass | Sweet clovers | Canada thistle |
| Red top | Red clover | Small white bind weed |
| Smooth brome | Marsh nettle | Bittersweet nightshade |
| Greater ragweed | | |

**WETLANDS AND EDIBLE WILD PLANTS:** Wetlands are especially rich in lush and diverse weeds because of their abundant moisture and fertility and because water level fluctuations and siltation and wave action periodically recycle the soil and vegetation and expose muddy shores where new weeds can get started.

A thousand years ago, the effigy mound-builders chose places like Picnic Point and Eagle Heights, overlooking wetlands, for marking their religious and burial sites: Wetlands with their weeds provided or attracted the abundant fish and waterfowl and plants as well as providing water, boat travel routes, and landmarks. Some weedy lowland and shore plants used by wildlife and probably by some Indians and/or early settlers but not grown commercially at present, are found here or are to be planted soon:

| **A. Water Plant Group** | **B. Grass and Sedge Group** |
|---|---|
| Cattail- (rhizomes, shoots, pollen) | Wild rice (seeds) |
| Bur Reeds- (bases, seeds) | Bulrushes (bases, tubers) |
| Arrowhead - (wapato or duck potato) | Chufa Sedge (tubers) |
| Water Plantain- (bases, seeds) | Wild-Millet (seeds) |
| | |
| **C. Sunflower Group** | **D. Other Groups** |
| Greater and lesser Ragweeds (seeds) | Lamb's Quarters Pigweed (cooked leaves) |
| Jerusalem Artichoke (tubers) | Marsh Nettle (cooked leaves; flavoring beer) |
| (from Girasol, French for sunflower) | Wintercress (leaves) |
| Bur Marigold (seeds) | Smartweeds & Knotweeds (seeds) |
| | Wild bean (roots) and Hog Peanut (seeds) |

No sign 23, 24, 25

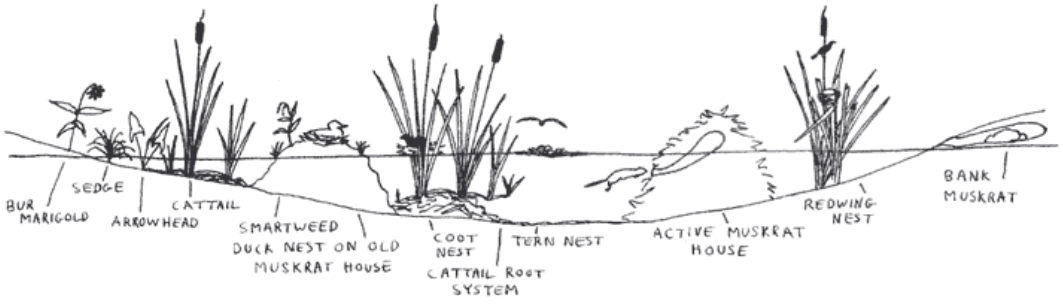
## Sign 26 - MUSKRAT - MARSH ENGINEER

You can easily see muskrats feeding or swimming about, as well as their houses (large) and feeding platforms (smaller heaps of vegetation). Not able to hibernate, the muskrat usually spends all his life in the water, dredging up roots and shoots of water plants from the bottom to eat. In winter, he still swims below the ice but may eat part of his house from the inside if food is scarce. Where water is shallow or absent, muskrat survive the winter by burrowing in steep banks and feeding on the upland grasses or crops. The trail here is occasionally undermined by a bank muskrat.

Muskrats would overpopulate, like rabbits, if not controlled by winter die-offs (deep freeze), predation by mink and trapping by man, and by a curious territorial mechanism: In the fall, the surplus muskrats (the weaker ones) are driven out of the marsh by the others - mostly to wander until eaten by some predator or run over by a car.

Muskrats in turn control the cattails, bulrushes, and duck potato population by eating them out in places, leaving sunny open water for ducks, fish and the small plants and animals they feed on. The ideal nesting habitat for water-fowl has a checkerboard of 50%. openings and 50% dense vegetation. Since plants tend to close in to form uniform dense stands, the muskrat is vital for creating the needed openings by dredging moats around each house and "leads" or "marinas" radiating out from each house.

Rat houses are also much used by ducks and turtles for resting and sometimes nesting; by smartweeds and cattails for seedling starting sites; and (when decayed and floating) by grebes and terns for nests. The new smartweeds and cattails in turn feed new ducks and muskrats, respectively.




No sign 27,28, 29

## Sign 30 - FOUR LAYERS OF GREEN

Like the tropical forest, the marsh efficiently captures maximum light energy with a complex layering of plant life. No wonder it is so productive of wildlife!

1. A canopy of **EMERGENT** plants takes its share first: cattails, bulrushes, arrowheads, bur reed (See sign 2). But their vertical leaves let much light pass through.
2. The **FLOATING** plants - Duckweeds - often get much of the rest; but - like the canopy plants - they come and go. These sometimes cover the water but are not algal scums. They include the world's smallest flowering plants - Lemna minor and trisulca; Spirodela; Wolffia; and two mosses - Riccia and Ricciocarpus. Eutrophic waters may have algal scums which trap much light. The floating leaves of water lilies and pond weeds can also intercept much light in places.
3. **SUBMERGED WATER WEEDS**, mostly rooted to the bottom, include nine groups, most of whose flowers are briefly borne above the water: Elodea (waterweed); Myriophyllum (several milfoils); Ceratophyllum (coontail); Ranunculus (water crowfoot); Potomogeton (many pond weeds); Vallisneria (wild celery or ribbongrass); Utricularia (bladderwort); Najas & Zannichellia (bushy and horned pond weeds). These form important hiding places for fish fry as well as food for insects and ducks. Clean open shallow water - where waterweeds get enough light - and a firm bottom for rooting are therefore important for waterfowl and fish spawning. The waterweeds are excluded at present by the siltation occurring here which makes the bottom too soft and the water too turbid (muddy).
4. **MICROSCOPIC PLANTS** (algae) of hundreds of kinds. A few, like Mougeotia and Spirogyra and Hydrodictyon, form strands or nets visible near the surface, but most are microscopic, single or few-celled, and fall into two groups: The free floating or swimming (plankton algae), and the attached (sessile) algae growing on waterweeds, turtle backs, and sticks and stones in the water. Although they receive only what light is left after passing through the other three layers, these plants are rightly called the "grass of the waters".

Often not visible except in green "soupy" eutrophic waters, the algae supply most of the abundant food base in the marsh. The energy they continually store is quickly "harvested" by small animals from protozoa to water fleas, and the larger "grazers" - tadpoles, snails and caddisflies. Their food then goes to small fish and predatory insects like dragonflies, and finally to larger fish and birds. Upland dwellers - racoon, snakes, hawks, lice, maggots, flycatchers and decay organisms (fungi and bacteria) - carry the food chain further, still dependent on what is now left of the minute percentage of solar energy that the algae have trapped in their food-making. You can see why muddy water can seriously hinder production all along the line by interrupting the vital light energy and wasting it.