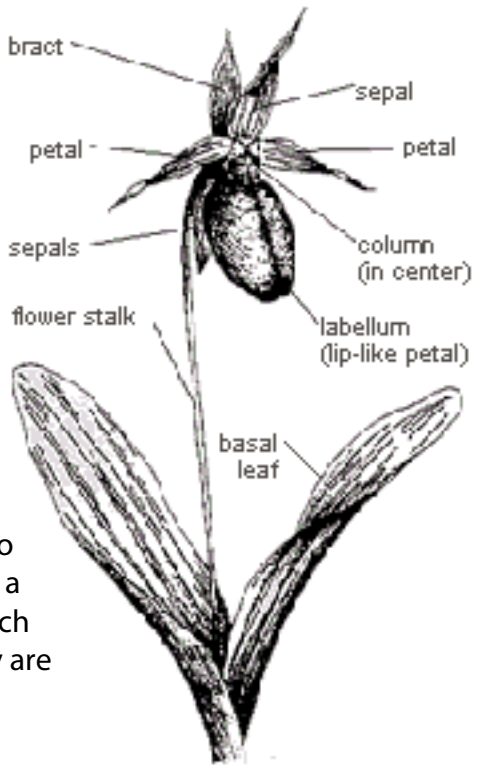
Orchids of New York State

Orchids in New York State

Of the 145 terrestrial species found in North America, approximately 60 species are native to New York State. New York has a wide variety of habitats for orchids mainly because of the wide variation of elevation, latitudinal and geological circumstances, plus unique conditions created and modified by the earlier glacial ages. New York is also a fairly large state, providing plenty of opportunities for climatic variations. Other states that are smaller or have a less-diverse range of habitats consequently have a lesser variety of orchid species. Some of our native species are quite showy, surpassing the beauty of their tropical cousins, while others sport small, insignificant flowers on miniscule plants. Only one species (Epipactis helleborine, or the 'Weed Orchid') is nonnative to North America and New York, originating in Eurasia. This species is unique in comparison to native species because it appears to thrive in many habitats and reproduces so prolifically. Our native orchids emerge and can flower from early April to late Fall with the coming of heavy frosts. Some of these orchids flower over a wide range of time, while others may only last a day at most. Many species can be found in very close association with one another, occupying the same location in the soil or sphagnum, or the same locality in a bog or fen. Tight microclimates may allow certain species to survive near localities they normally would not be found. For example, the Pink Lady's-Slipper (Cypripedium acaule) is often found in acidic or sandy locations in Pine Barrens or woodlands, but may be found on hummocks above the acidic waters of bogs, or around the roots of acid-creating trees or shrubs that are found in alkaline fens.

What is an orchid?

Orchids are the largest family of *angiosperms* (flowering plants) in the world. Approximately 30,000 species, or 10% of all known species of flowering plants are orchids. The most familiar orchids are those found in tropical regions. Many tropical orchids have large, showy, colorful flowers, and are often used by florists in fancy bouquets and corsages. These tropical species are typically *epiphytic*, meaning that they are found growing above ground, in tree crotches or attached by their roots to the bark of other plant species, although a fair percentage grow on the ground, which makes them *terrestrial*, or if on rocks they are considered to be *lithophytic*.



Name

Why orchids are unique

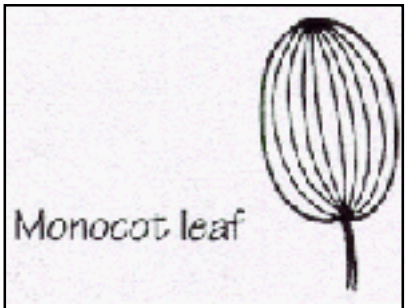
Orchids are considered to be the most evolved of the flowering plants. These plants have evolved to be able to survive in very specialized habitats. Each orchid species will germinate and grow only when these habitat requirements are optimal. Orchids are also unique in their methods of fertilization, seed production, germination, and pollination strategies. For example, a particular orchid species may have evolved so that only one size and type of pollinator can move about it's flower, in the proper direction and sequence so that the pollen can be placed on the pollinator without its being removed before being placed on the next flower. Many other flowering plants (Including some Cypripedium orchid species) ensure pollination by allowing profuse quantities of pollen to be showered over the entirety of the pollinator so that no special requirements need be met to pollinate the next flower it comes to. Many other plants just allow their pollen to float through the air, and pollination becomes a chance event of a pollen spore finding another of the same kind of plant.

Terrestrial orchids

In North America, approximately 1,000 species are found throughout the continent. Most North American species are found in tropical and subtropical areas of Mexico and Florida. In addition to these species, approximately 145 species are found in more temperate areas. These temperate species are terrestrial and *perennial* (growing in the soil or other substrate, possibly emerging and flowering each season, then entering dormancy at the end of the season).

Flower Structure

Orchids are considered to be *monocots*, which are distinguished from other angiosperms by having only one *cotyledon* or leaf that first emerges from the seed. Monocots typically have flower parts in groups of three or six, and this is exemplified by the structure of the orchid flower. Orchids have 3 *petals* that are typically the showy, colorful part of the flower. Of these three petals, one is typically quite different than the other, forming the distinctive lip or *labellum* common to most species. Orchids also have three *sepals*, often situated under and between the petals. Depending on the species, the sepals can be quite colorful or simply green. Orchids are distinguished from other plant families by the fusion of their reproductive parts (*stamen*, male; and *pistil*, female) into a *column*, found at the center of the flower. The male part of the reproductive structure holds the *pollinia*, which is dislodged by a pollinator and carried to another flower, thus starting the reproductive process. Orchids also are distinguishable by the presence of an inferior *ovary* or structure where germination takes place and seeds are formed. Whereas most plants have an ovary that is surrounded by the floral structure in the central part of the flower, the orchid ovary is found beneath



Monocots characteristically have one cotyledon or seed leaf, parallel-veined leaves, and flower parts in a series of three.

the flower, appearing more like a swollen stem than a reproductive structure. The column structure is also believed to regulate which type of pollinator can get close enough to place viable pollinia. Depending on the physical characteristics of the column, it can 'direct' the pollinator of the right size and shape to the spot necessary to deposit or receive the pollen mass to or from the flower.

tiny orchid seeds

Seed Production and Structure

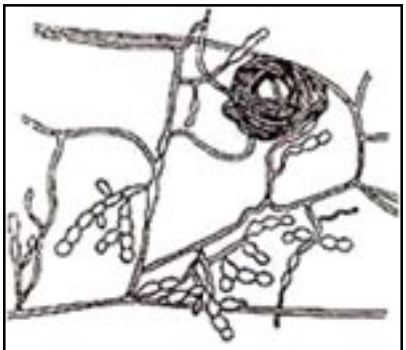
Orchids produce the smallest seeds of any flowering plant. A typical seed pod can contain millions of dust-like seeds. Unlike other plant species, these minute seeds lack an *endosperm* or food source, resulting in a small *embryo* covered only by a thin protective wall. This lack of reserves and protection makes the seed extremely vulnerable, resulting in a high mortality rate. In the tropics, seed pods can remain on a plant for many months, but many of our natives form seed very quickly, and the pods will often open within a month or so after formation. Other species may open at different intervals, depending on the particular survival strategy that species has evolved to allow the seed to be released when the best conditions for dissemination, germination and survival are found. Seeds are most often disseminated by wind or water.

Mycorrhizae, germination and survival

Orchids require the relationship with a fungus for their existence. The importance differs among species, the "infection" by the fungus being heaviest in temperate terrestrials, but light in tropical epiphytes. The relationship is essential for the germination of the seed of all orchids in the wild, and remains essential for a few species throughout life. Orchid seeds pass through a nongreen ("*achlorophyllous*") developmental stage when they cannot use fats, break down starch, obtain phosphates or photosynthesize, and therefore rely on an external source. This is provided either by man in the form of simple carbon-containing foods in sterile seed germination, or by a fungus which breaks down complex compounds into simpler ones in symbiotic

---

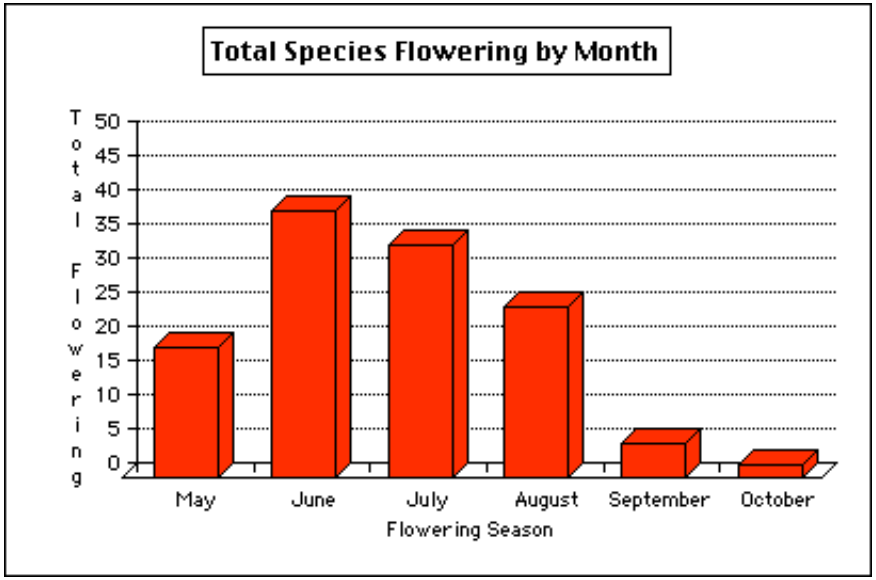
germination. The fungal *hyphae* penetrate via the base end of the seed. The hyphae enter the cells and coil into structures called *pelotons*. Germination of the seed into a *protocorm* follows. The cells eventually digest the pelotons, but occasionally the fungi become parasitic and destroy the protocorm. In some species chlorophyll never does develop, so the orchids rely totally on associations with fungi. In others, the leaf size is too small to support the rest of the orchid, and the orchid continues to rely partly on the fungus for its nutrition; such plants have been called *saprophytic*, but that is an incorrect application of the term. The partnership between orchid and fungus has been called *symbiosis*, or a "delicately balanced mutual antagonism', or plain parasitism (of the orchid on the fungus). Fungi that are apparently symbiotic can turn and attack the orchid; with many terrestrial orchids it has been found that the fungi that is digested in their root tips are in turn parasitizing host trees and shrubs, so that the orchid itself was an indirect 'parasite' (Orchid > Fungi > Tree), so the relationship is by no means a completely equitable one. "Symbiosis" suggests mutual benefit and indeed Cymbidium and its fungus each require the vitamin *thiamine*, made up of *thiazole* and *pyridine*; the fungus supplies the thiazole and the orchid supplies the pyridine. Most orchid-associated fungi can, however, live without the orchid, and it seems that whereas the fungus supplies the orchid with a range of nutrients and stimuli, the orchid usually provides little in return. Many orchids have "host" cells that store fungus, and adjacent digestion cells that break the fungus down by means of substances known as *phytoalexins*. Some studies in the laboratory suggest that specific orchids require specific fungi, but few associations have been studied in the wild. Fungi are difficult to isolate and difficult to grow (especially to the usually readily identifiable perfect state), and the fungus required by the protocorm may be different from that required by the adult. Certainly some orchids



The orchid fungus Rhizoctonia repens

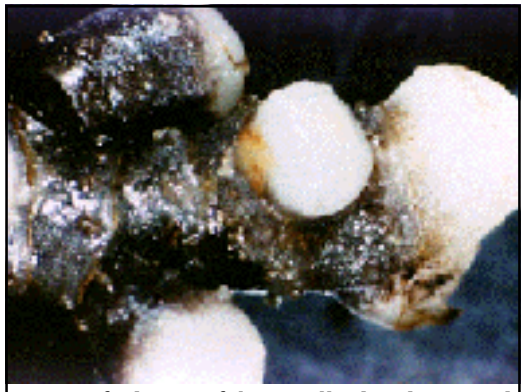
can establish successful relations with several different fungi. So, it is difficult to say with certainty which fungi must be present in order for an orchid population to survive over a long period of time. Studies have shown that many terrestrial orchids only exist where their fungal partner is present, and often these fungi are also specific for a different host, so that orchids end up being found in exclusive association with other plant species.

Initial contact between fungus and seed is haphazard - there is no evidence that an attractant is used by the orchid seed. Seeds appeared to resist entry by incompatible fungi, while allowing the entry of compatible fungi. There was a strong specificity of fungus for each orchid studied. Pelotons appeared about a week after initial infection in some cells and signified a compatible orchid/ fungus match that would lead to germination. The protocorm seemed to have entry, holding and digestion zones for the fungus, though the way the fungus is controlled in these zones is unknown. Failure of germination was caused by fungal hyphae failing to penetrate the seed, or by penetrating all the embryo's cells resulting in death of the embryo .



Flowering time

Many terrestrial orchids take over 10 years to flower after germination. The symbiotic relationship between orchid and fungus often persists indefinitely. The fungus continues to supply nutrients and energy to the plant, allowing it to survive and develop for long periods underground. The orchid may supply some photosynthetic products (sugars and starches) to maintain the fungus. Some terrestrial orchids, like several Corallorhiza species, contain no chlorophyll (or leaves) and depend entirely on the fungus for their nutrition. After the large expenditure of energy required for creating floral plant parts and possible reproduction, the plant may return underground for several more years. During this underground phase, the orchid survives from it's food reserves provided by it's Mycorrhizal symbiont. The orchid will reemerge when nutrient reserves (and other environmental conditions) are sufficient for another attempt at reproduction. This underground phase helps to explain why many orchid species are not found flowering in the same place from year to year. Research has shown that some species may disappear from an exact location for as long as 20 years before reappearing to flower again!



A magnified view of the coralloid underground rhizome of Corallorhiza striata. The black color comes from the color of the hyphae of the endophytic fungus (mycorrhizae); the white tips are not yet infected

Sensitivity to the Environment

Because the evolutionary path of orchids has been extremely long, each species has had the opportunity to adapt to specific niches in their environment. Each species is typically associated with a specific set of habitat conditions such as nutrient availability, pH, sunlight, environmental temperatures and water. For example, some orchid species need a certain amount of calcium, a rich supply of nutrients and a neutral-to-high pH to thrive. These orchids are only found in calcium-rich fens. Other orchids cannot tolerate rich nutrient levels, and/or are outcompeted by more vigorous plants in such an area. If a certain set of conditions are not met, certain species of orchids will not grow in a given area. Because orchids are so selective, if a habitat changes in any way, a given population may perish. This sensitivity may be the result of the specific conditions needed to form the Mycorrhizal association mentioned previously. Because some orchids are considered *mid-successional* species and are poor competitors with other vegetation, certain species will respond positively to disturbances such as mowing, logging or fire. After such a disturbance, these orchids thrive and can repopulate an area. Often these plants haven't left the area, but the lack of light has prevented their collecting enough light energy to grow to adult size and to initiate flowering. When a canopy species is removed, the orchid species is allowed to emerge and flower again, if other disturbances have not destroyed the growing area. Another environmental factor that may greatly impact an orchid's survival in a particular area is temperature. Certain Cypripedium species only grow and thrive in cool climates. The warming of our environment has proceeded rapidly in the last few years, and it is popularly believed that warmer temperatures are the reason why these species have been found less often in the Southern parts of their range, but have newly emerged in areas further North. Some species formerly more common in New York are now found more commonly up North in Canada. Also, some orchid species must have a loose, airy soil medium in which their roots may grow and absorb oxygen, and any traffic or disturbance that compacts the soil can greatly lower their chances of survival.

Conservation and Protection Issues

The importance of biodiversity

Biodiversity refers to the natural species composition of organisms (both plants and animals) in a given ecosystem. If all these species are present in a given ecosystem, this indicates conditions are optimal for the healthy functioning of the ecosystem. All life on earth is dependent on these ecosystem processes, therefore, maintenance of biodiversity is an essential and worthwhile endeavor.

Why conserve orchids?

According to the New York Natural Heritage Program, when rare plants are protected, distinctive populations of species are preserved along with their genetic variation within their natural habitat. Because orchids are the most evolved of all flowering plants, they are very site-specific and need optimum conditions to thrive in a given ecosystem. If orchids are present in an ecosystem, this is a good indicator of a healthy, functioning ecosystem. Additionally, many orchid flowers and their habitats are beautiful, and provide pleasure to those who seek out these unique members of the plant kingdom.

Visiting orchid sites

Discovering an orchid growing in the wild is an exciting experience. Once discovered, the places where these rare, beautiful plants grow can become popular sites for naturalists, photographers, and unfortunately, poachers. As stated previously, these plants are very sensitive to disturbance. Just visiting and admiring these plants in the wild could potentially harm their chances of survival. When visiting a site, tread lightly! Remember, some orchids can remain underground for several years, so you may be disturbing the habitat of one plant while stooping to photograph another. Repeated abuse of this kind may eventually destroy some or all of the population.

Photography

While photographers are typically innocent admirers of orchids, some will remove 'spent' flowers to get that perfect picture. While this doesn't hurt the individual plant, it has lost it's chance to form seeds and expand it's population. Some photographers will go so far as to remove and kill the plant, assuring that no one else has the chance to photograph it! Not only is this illegal, the consequences to the plant are obvious.

Poaching

The worst crime against orchids is poaching. Some are not satisfied to just seek out and observe orchids in their natural habitat, but transplant these plants to their yards or sell them to nurseries. Primarily, this is illegal according to the NY Environmental Law, although the fines are small for those obsessed with possessing a rare plant. According to Keenan (1998), poaching has extirpated all of the beautiful Showy Lady's-Slippers (Cypripedium reginae) from Acadia National Park in Maine. Obviously, poaching destroys natural populations of orchids, but other detrimental effects may be less obvious. First of all, removing plants from their natural habitat doesn't allow anyone else to enjoy their beauty. Secondly, since orchid habitats are so sensitive, they typically die several years after being transplanted into a garden. Not only does this kill the individual plant, it also destroys it's chances for reproduction and continued survival in a given area.

Collecting and buying orchids

The NY Environmental Conservation law ensures protection for all orchids in New York State. All of these plants are considered exploitatively vulnerable, while some are afforded protection as threatened or endangered species. Recently, some nurseries are offering orchids for sale, often at high prices. Because orchids are so difficult to propagate from seed, some requiring over 10 years to flower, these nursery plants are sometimes the result of orchid poaching. While some nurseries advertise 'nursery propagated' plants, this may only indicate the plants were removed from their habitat and have been held at the nursery for a few years before selling. Exceptions do exist nowadays. Some nurseries gain

---

permission to collect orchids from a site destined for destruction, such as a new construction site. Also, new propagation techniques and patience with growing from seeds have allowed some species to be offered on the market. It is best to avoid buying orchids from a nursery, unless you have researched your vendor and know that they and their goods are legitimate. If these plants were illegally removed from their habitat, their chances of surviving in a new environment are very low. If you are lucky enough to acquire a legally-produced, nursery-propagated orchid, these plants are difficult to grow and should only be attempted by the advanced gardener. As a final thought, if and when you find and observe orchids in their native habitat, be cautious about who you reveal their location to.

Reintroduction of native orchids into habitats

One method of conservation is to try and reintroduce natives into areas that once held them, or other habitats that are very similar. It would seem logical that the germination of orchid seed in the wild would depend on the amount of fungus in the soil, but this may not be true. There are implications for the re-siting of rare orchids - if there is a single fungus associated with an orchid, a new site will need to be apt for the fungus as well as for the orchid: if the fungus does not survive, neither will the orchid. Some orchids that have been moved into a new habitat may live for a few years, but then dwindle away with no new seedlings produced. If the proper mycorrhizae are not present, then the chances of there being new orchid seedlings are slim to none. Careful testing of the soil and the habitat would best be done before attempting to place an orchid into it.

Conservation organizations

If you own or know about a piece of property that has orchids on it, consider placing it in trust to a local or national conservation agency, or even selling it to them. There are many local and national agencies that purchase and/or oversee the rights to management of special horticultural areas, especially ones that have rare plant species or unique habitats found nowhere else in nature. This will ensure that future generations will be able to view these natural treasures in areas that will be protected from development and destruction.

Where Orchids are found

Orchids are found in the wettest swamps, the highest mountains, the deepest woods and the sandiest beaches/dunes of New York State. Wherever you go, there is or probably used to be an orchid colony growing nearby. Many habitats were filled in or bulldozed for housing or commercial development, or were destroyed when the forests were clear-cut for timber or farmland.

Bogs and wet meadows

Peat accumulating wetlands with no significant inflows or outflows of water except precipitation. Low in nutrient content, low in plant species diversity. Bogs are dominated by Sphagnum mosses, with common tree species being Alder (Alnus rugosa), Tamarack (Larix laricina) and Black Spruce (Picea mariana), and can often include Sundews and Pitcher Plants. pH is typically acidic due to decomposition processes and lack of groundwater input. Wet meadows are an area with waterlogged soils and are dominated by graminoid species (grasses and sedges).

Fens

A peat accumulating wetland that receives groundwater input from surrounding or underlying mineral soil or parent rock. Fens have a higher nutrient content than White-Cedar or acidic Sphagnum bogs, contain significant amounts of calcium, magnesium and other nutrients, support a high diversity of plant species, are pH circumneutral to basic due to groundwater inputs. Rich and Poor fens are designated often by the amount of alkaline and/or organic material found in the fen. Poor fens often resemble acidic bogs, but differ somewhat in the plant species found in them. Often dominated by graminoid species (grasses and sedges) and other indicator species.

Rich mesic forests

A moist forest, neither very wet or very dry. Dominated by hardwoods such as Sugar Maple (Acer saccharum), Beech (Fagus grandifolia) and Yellow Birch (Betula alleghaniensis), mixed with conifers such as Hemlock (Tsuga canadensis). Soils are typically moist and contain a sufficient

---

supply of nutrients to support a wide diversity of plant species. At higher elevations, these forests can be dominated by conifers such as Spruce (Picea spp.) and Balsam Fir (Abies balsamea). Often the presence or absence of a leaf-litter zone above the soil can have a great impact on the species found in rich mesic forests.

Dry mixed forests

Not as rich and moist as mesic forests. Dominated by a mixture of hardwoods and conifers, typically less nutrient-demanding species such as Red Maple (Acer rubrum), Oaks (Fagus spp.) and Pines (Pinus spp.). pH is more acidic than in rich mesic forests. Soil contains fewer available nutrients than rich mesic forests.

Other orchid habitats

Dry fields may have low nutrient content, have high clay content and/or be fairly compacted, and will often be dominated by grasses. Pine Barrens are typically drier and fairly sandy, with possible wet zones in lower areas. A 'displaced' Pine Barren may be found in areas not presently near a local water source, amongst glacial depositions and/or rich/dry forests. Thin fields often have had topsoil removed, or there may only be a thin layer of soil above bedrock. Often thin fields can have standing or slow-moving water and be wide continuations of wet ditches. Ditches can often have many different types of soil material, and have deposited organic matter pooled into lower areas. Depending on the grade and the underlying material, they can be very wet to very dry. Roadsides can have a mix of habitats, from wet soils to dry, compacted or well-drained soils, and can include dry or wet areas in and around rock cuts or outcroppings. The degree and height of a roadside slope can also have a large impact of the species found there. Orchid species found in these variable areas depend greatly on the degree of disturbance in the area, the amount of time passing since disturbances occurred (successional stages), the amount and duration/timing of standing water, the organic and parent material components found and the amount and duration of sunlight reaching the area.

Acknowledgments and Credits

A large portion of the habitat and conservation information used in this educational exhibit came from the SUNY College of Environmental Science and Forestry at Syracuse, NY's website, specifically The ESF Roosevelt Wild Life Station webpage of New York State Native Orchids. Very kind permission was granted by Prof. Donald Leopold for use of the text, graphics and images. The web address for this site is: http://www.esf.edu/resorg/rooseveltwildlife/Research/Orchid/orchid.html
It is a wonderful site that everyone with Internet access and an interest in orchids and native orchids should visit.

Most of the individual species information was used from 'Wild Orchids of the Northeastern US: A Field Guide by Paul Martin Brown'. Mr . Brown also very kindly supplied some images for this display: Photos copyright Paul Martin Brown from The Wild Orchids of North America, North of Mexico, University Press of Florida 2003. Information was also used from Philip E. Keenan's wonderful documentary of his orchid searches: 'Wild Orchids Across North America - A Botanical Travelogue.' Information about orchid mycorrhizae and relationships was elicited from the New Zealand website: http://www.anos.org.au/groups/newzealand/biology/fungi.htm
It is an excellent website with very detailed information about the secretive associations between orchids, fungi and hosts of fungi.

There are several edits and additions of the above sources from my own experiences in the field and in communications with others. Two photographs in the display of Tipularia discolor and Spiranthes lacera var gracilis are copyright 2003 Guy Tudor.

Other images were very kindly supplied and are Copyright 2003 Dave Clemens. Special thanks goes to Daniela Photography of James St., Utica, NY . All other prints used Copyright 2003 Charles Ufford.

Tremendous thanks goes to the many people who helped me with locations of native orchid colonies and allowed me to join them during native orchid excursions. You know who you are, and I am leaving your names anonymous to free you from the burden of fielding and screening requests for location information. Rest assured that thanks is extremely heartfelt, as this display would never have happened if it weren't for your support! (Two thumbs up)

Other special thanks goes to the Central New York Orchid Society, Matt Young, Patti Coan, Paul Martin Brown, Brian 'the butterfly man' Cassie, Guy Tudor, several people at the Nature Conservancy and the New York Museum and Natural Heritage Program, and most of all to the late Jim Rice, who inspired many of us to go bog-trotting and to love orchids!

Conservation Organizations

Here is contact information for New York agencies that are responsible for protecting lands that support native orchids. Feel free to contact them for more information, or to donate any time, money or lands that you might have available to help preserve our native orchids.

The Nature Conservancy http://nature.org/ The Nature Conservancy 4245 North Fairfax Drive, Suite 100 Arlington, VA 22203-1606 Phone:(703) 841-5300

Finger Lakes Land Trust http://www.fllt.org/ Finger Lakes Land Trust 202 East Court Street Ithaca, NY 14850 Phone: (607) 275-9487

Bergen Swamp Preservation Society http://www.bergenswamp.org/ Bergen Swamp Preservation Society, P.O. Box 460, Bergen, NY 14416-0460, (585) 548-7304

Izaak Walton League http://www.iwla.org/ National Office 707 Conservation Lane Gaithersburg, MD 20878 Phone: Toll-Free: (800) (453-5463)