PART TWO

WHERE TO GROW CARNIVOROUS PLANTS

AS WE HAVE SEEN, most carnivorous plants come from rather similar habitats. The most pronounced differences are the climates from which the individual species originate. Some varieties may require extremes of heat and cold, wetness or dryness, higher or lower humidity, photoperiod fluctuation, and so on. Therefore, there is no ideal situation in which one can grow all carnivorous plants all of the time. But there are several artificial environments in which a rather large variety can be grown. Some plants, on the other hand, may require rather specialized treatment.

But certainly gone forever are the myths that carnivorous plants can only be grown in humid terrariums or hot, steamy stove houses. Thanks to the years of experimentation by growers around the world, one can find CPs not only in greenhouses and indoor tanks, but on windowsills, decks and patios, corporate offices, outdoor bog gardens, and even in basements.

Following is a list of some of the many diverse places you can grow these unusual plants.

GREENHOUSE CONDITIONS

The controlled environment of a greenhouse is no doubt the most ideal place to grow beautiful carnivorous plants. Here is a listing of the most basic greenhouse conditions, but for more detail I suggest you also consult one of the many good books that are available at libraries, bookstores, and home-supply businesses. What follows is a listing of the main concerns for a good and functional greenhouse.

Heating

There are certainly some carnivorous plants that can be grown in unheated greenhouses, even if you live in a climate with cold winters. But most people will find it necessary to heat their greenhouses if they wish to grow a wide variety of CPs. It is always best to have the heat mechanically controlled with thermostats, and fans are helpful to circulate the air while the heat is on. Small greenhouses can often make do with space heaters designed for this specific use, and many larger heating systems are available from greenhouse specialists.

Shading

This is a requirement for most houses, and is very helpful to cut down on heat buildup from the sun, known as greenhouse effect. The two most common shading methods are shade cloth and whitewash. Usually a 50 percent shade cloth is ideal for CPs. Any denser cloth, such as 70 percent, will be too darkening for the health of most CPs. Whitewash is usually gypsum mixed with water, which is then "painted" on to the roof and sides of the house. However, whitewash frequently has to be replaced, as rain will gradually wash it away. Be warned that gypsum, being alkaline, is lethal to most CPs if it is applied by accident to their soil or water. Therefore shade cloth is often the safest product to use.

Fans

Exhaust fans in the greenhouse are another requirement, and should be set by a thermostat to turn on when heat reaches a certain temperature, usually between seventy and eighty degrees Farenheit. Automatic vents on the opposite end of the house will allow cooler outside air to enter.

Swamp or Evaporative Coolers

This is an often necessary method to cool and humidify most greenhouses. As temperature goes up, humidity goes down, and simple exhaust fans on a very hot and dry day will simply draw in hot and dry air through the house. There are many types of swamp coolers available on the market. The general systems have water dripping through pads, which is recirculated from a water reservoir. Fans are necessary to produce the effect. In small, free-standing units that look like air conditioners, a built-in fan blows air through the pads, cooling and moist-

ening the air through an "evaporative" method. These are often called "personal coolers" in department stores. The method is the same for larger units, but typically a wall on one end of the greenhouse contains the large, water-moist pads, while the fans are usually exhaust fans located on the opposite wall of the house. When the fans are engaged, hot, dry air from the outside is drawn in through the pads by the fan's effect, cooling the temperature of that air by ten to twenty degrees while adding humidity by evaporating water.

Misting Systems

These cooling systems operate by atomizing water into a cooling mist, and can be quite effective for many greenhouses, especially where low humidity is a concern. But be warned that the water source should be purified or of a low-mineral content. Otherwise, the mist nozzles will become clogged by mineral salts and CPs will be harmed by the minerals deposited upon their leaves and soil. (And they will look unsightly when these dissolved salts dry up on their foliage.) Some plants, such as sundews, will not appreciate having their leaves frequently wetted by mist, but others, such as *Nepenthes,* thrive in such conditions.

Humidifiers

Small room humidifiers can be purchased through greenhouse suppliers, as well as home-supply businesses and drugstores. These small units are inexpensive and helpful when added humidity is needed in small greenhouses. Typically, humidifiers have small reservoirs to hold water, which is then heated and released as a vapor. These units can also be helpful for larger propagation chambers.

Air Conditioners

If you live in a climate that has extended periods of warm summer nights, yet wish to grow carnivorous plants adapted to chilly night temperatures, you may consider installing an air conditioner in your greenhouse. Some varieties of CPs require a substantial drop in night temperatures for good growth, among them highland *Nepenthes, Darlingtonia, Heliamphora,* and *Drosophyllum.* Temperatures where these species grow often drop into the fifties at night.

Types of Greenhouses

Here I will slightly amend the general information on greenhouse types and simplify their descriptions to suit the cultivation of carnivorous plants.

The Cold Frame

This type of greenhouse is unheated, except through solar radiation (the sun). This means its usefulness is dependent primarily on the climate you live in. In areas that experience cold winters, where temperatures are often below freezing, you can thus only grow carnivorous plants that come from similar climates. Generally these species have long, sustained winter dormancy. Some suitable species are *Pinguicula* from the northern latitudes, such as *P. vulgaris, P. macroceras, P. longifolia,* and *P. grandiflora; Sarracenia purpurea ssp. purpurea; Drosera rotundifolia, D. anglica* and *D. intermedia* from the northern latitudes; and those species of *Utricularia* that are from cold temperate climates.

Alternatively, if you live in a warm-temperate climate where cold winter temperatures only occasionally drop below freezing, a wider selection is available for cold frames. An unheated greenhouse in the southeastern U.S. coastal plain, much of California, the Mediterranean countries, or the subtropical coastal areas of Australia, for example, can be home to a wide range of CPs. All *Sarracenia* would be suitable, as would *Dionaea.* Temperate to hardy subtropical sundews, butterworts, and bladderworts would also do well, as would the dewy pine and cobra plant, among others.

A large commercial warmhouse with a hothouse in the background.

The Cold House

This type of greenhouse would be heated when temperatures drop below thirty degrees. Suitable plants for this environment are: all *Sarracenia, Dionaea, Darlingtonia, Drosophyllum,* temperate and subtropical *Drosera, Pinguicula, Utricularia,* and *Aldrovanda.* At some risk would be the pygmy and tuberous sundews from western Australia, if the foliage were allowed to freeze.

The Cool House

Heated at forty degrees, this would be a safer environment for the plants mentioned in the preceding paragraph. But you would also be able to grow some Mexican butterworts, *Cephalotus,* and at least one *Nepenthes* species: *N. khasiana.* A few of the more cold-hardy highland *Nepenthes* species and hybrids may stop growing in winter but otherwise should survive. *Heliamphora* would do well also.

The Warm House

Heated at around fifty degrees, this type of greenhouse is ideally suited for growing a wide variety of carnivorous plants. Although a low of fifty degrees is considerably warmer than many CPs would experience in the wild during their winter dormancy, the naturally shortened photoperiod of winter would keep them dormant for a suitable enough time, unless you live in the tropics. However, the warm house would not be the best for plants from a northern latitude such as *Pinguicula vulgaris* or *Drosera rotundifolia,* which may do better in winter if they're placed under benches where cooler temperatures might be maintained. It is also not wise to allow the greenhouse to get too hot on sunny winter afternoons; exhaust fans should be set to cool the greenhouse at around sixty degrees.

Highland *Nepenthes* in a warm house

Varieties suitable for the warm house are *Sarracenia; Dionaea;* most temperate to subtropical *Drosera,* including the pygmies and winter-growing species; all subtropical and Mexican *Pinguicula; Darlingtonia; Heliamphora; Roridula;* temperate, subtropical, and epiphytic *Utricularia; Drosophyllum; Byblis; Cephalotus; Aldrovanda; Ibicella;* the carnivorous bromeliads; and the highland *Nepenthes.*

In short, the only unsuitable varieties for the warm house would be the species from the most northern latitudes and the lowland tropicals, particularly lowland Nepenthes.

The Hot House

The heat goes on in the hot house when the temperature drops below sixty degrees. This is a good environment only for those plants considered tropical. Highland *Nepenthes* do well here, particularly if daytime temperatures don't exceed eighty-five degrees. However, much more suitable are the lowland *Nepenthes,* although a few of these might slow their growth in winter. Tropical sundews, *Genlisea, Byblis liniflora, Ibicella,* and Mexican butterworts thrive in hot-house conditions. Humidity should be high at all times.

The Stove House

Temperatures are maintained above seventy degrees, with hot days in the eighties and nineties. Only true lowland tropical species should be grown here, such as the lowland *Nepenthes, Genlisea,* tropical *Byblis,* and *Drosera.* High humidity is also essential.

Remember that if your greenhouse is large enough, you can always build a small enclosure within it and heat this section separately from the main growing area. An example of this would be heating the main section at fifty degrees (warm-house conditions) while heating the enclosure at, let's say, sixty-five degrees (somewhere between hot and stove house requirements). You can then grow lowland tropicals in this smaller space while more temperate or highland tropicals are maintained in the main house. The heating can be accomplished with small space heaters set on a separate thermostat. Heating pads used for propagation are also suitable for the warmer enclosure. Set at seventy degrees, a heating pad (there are many types available) will keep the pots warm while the air may be somewhat cooler.

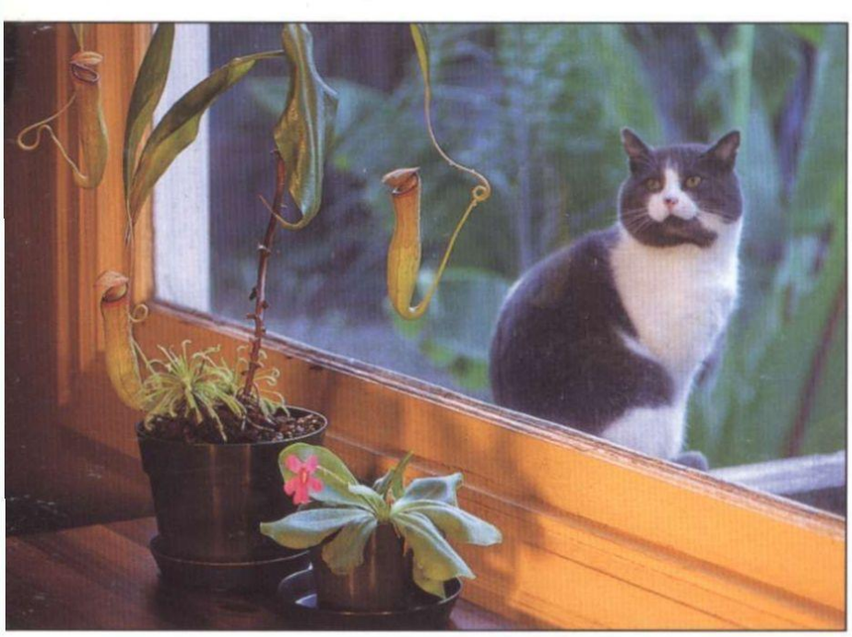
Likewise, smaller enclosures within the greenhouse can be cooled separately with an air conditioner or small swamp coolers, should this be necessary in your area to grow the plants requiring cooler climates.

Windowsill Growing

A *Nepenthes* in your living room? Sundews over your kitchen sink? Butterworts in your bathroom?

Twenty years ago many carnivorous plant enthusiasts would have raised eyebrows over such possibilities, assuming that to grow a CP indoors, terrariums would be a requirement. Not necessarily so. From London to New York to San Francisco to Melbourne, many carnivores are finding happy homes in people's houses and offices, requiring minimal care while offering maximum pleasure.

This does not mean you can grow a Venus flytrap wherever you grow a parlor palm. Most houseplants are cultivated for their low light tolerance, and in fact may dislike or be burned by direct sun. CPs in general are sun lovers, and this is perhaps the most important fact to consider when choosing carnivores to grow indoors.



***Nepenthes khasiana, Drosera copensis "alba,"* and *Pinguicula moranensis* growing in the author's living room**

I use the term "windowsill" to stress the point. Most carnivorous plants, to be successful indoors, usually need to be as close to a window as possible. A windowsill or tabletop right next to the glass is the brightest place in a room, and this is what CPs would typically require.

Furthermore, since most carnivores are sun lovers, direct sunshine streaming through the window for at least part of the day is also a necessity, although there are a few exceptions. Direct sun should hit most CPs a minimum of two to five hours during the growing season. Bearing in mind that the sun moves about in the sky from season to season, there are few windows that receive the same

amount of sun throughout the year. Many people in the northern hemisphere assume south-facing windows are the sunniest, but this may only be true in the winter when the sun is low in the southern sky. Come summer (the primary growing season for most plants) when the sun moves directly overhead, a southern-exposed window may receive no direct sun at all, especially if your house has a roof overhang.

Most growers have found that east- or southeast-facing windows that, in the northern hemisphere, receive cooler morning sun, are probably the best indoor location for CPs. West- and southwest-facing windows are also quite good, but if the afternoon sun is too hot in your house, screening or sheer curtains may be needed to make the sunlight less harsh and keep the plants from burning.

There are several things to consider when growing carnivorous plants indoors. If you wish to grow temperate plants, such as the Venus flytrap or American pitcher plants, you will have to take strong heed of their dormancy requirements. It will be the shortening of the daylight period that will trigger the plant's rest period. Dormancy also requires cooler temperatures. Your plants won't necessarily require temperatures as cold as in their native habitat, but dormant plants should certainly be protected from hot sun and warm temperatures indoors.

It is therefore wise to move such dormant plants outdoors, if your climate can sustain them, or perhaps to the coolest north-facing windowsill in a room that is not overly heated, especially at night. Basement and garage windowsills can fill this requirement, as can enclosed porches that get chilly in the winter.

Some folks who have no such environment to place dormant plants may instead remove the plant from its soil late in the season and store the rhizome in an airtight plastic bag after trimming whatever leaves may be remaining on the plant. A few strands of damp, long-fibered sphagnum moss or a handful of moist peat moss can be added to the bag, and the bag may then be refrigerated over winter. Come late winter, the rhizome is repotted and the plant returned to the windowsill.

Minimum dormancy for temperate plants should be around three months. In the United States, I like to remind people that plants should enter a rest period sometime between Halloween and Thanksgiving and can be brought out of dormancy as early as Valentine's Day but no later than Easter. By March, and the approach of spring, the well-rested plants will begin the season's growth.

Of course, many subtropical and warm-temperate CPs will continue to grow through winter and won't require a cold rest period, although they may slow down their growth. These plants, like *Cephalotus,* Cape sundews, or the Mexican butterworts, will be happy year round on the windowsill. You may want to grow such plants on a sunny, south-facing window in winter, and by spring, move the plants to an east- or west-facing window for the summer.

Alternatively, you may grow plants outdoors in the summer and then move them to a sunny windowsill for winter, to protect them from unsuitably cold weather. In a city like Boston, you might grow Mexican butterworts or Cape sundews outdoors for the summer, then move them to a windowsill before the first frosts. Remember, if you do this with a Venus flytrap or yellow trumpet plant (perhaps because your winters are too cold to leave them outdoors) be sure you respect their rest period and keep them in a cool and sunless window.

Success with windowsill growing may depend on where and how you live. Humidity is certainly important for carnivorous plants indoors, but not as important as good light. If you live near a coastline, indoor humidity is often suitable for CPs. If you live in a desert community, air conditioning or evaporative coolers will often help plants grown on windowsills. In winter, heating your house may drop humidity drastically, especially with energy sources such as woodstoves. You may want to keep a kettle on your woodstove to replenish water vapor.

Misting indoor CPs can be quite beneficial, and I recommend you keep a spray bottle of purified water near your plants if your house is on the dry side. Wetting the foliage in the morning and evening would be appropriate if your humidity is low.

The following are all suitable for the windowsill, if conditions are appropriate: Venus flytraps; most Mexican butterworts; *Sarracenia* species and hybrids, although all will require much direct sun; most terrestrial and epiphytic bladderworts that are subtropical to tropical in origin, such as *Utricularia livida, U. sandersonii, U. reinformis,* and *U. humboltii; Aquatics* such as *U. gibba; Cephalotus; Byblis* species; Sundews such as rosetted subtropicals, Cape sundews, *Drosera regia, D. binata; Darlingtonia* will do well if your house is cool; highland *Nepenthes* such as *N. khasiana, N.* x *rokko, N. alata,* and *N. ventricosa,* including hybrids. Some lowland hybrids can also do surprisingly well, such as the beautiful *N.* x *dyeriana,* which has some highland ancestry.

Terrariums and Tanks

The method of growing carnivorous plants in tanks is still one of the most popular and enjoyable ways to raise carnivores. Not only can a well-presented tank of flesh-eating plants rival a commonplace aquarium for decorative beauty, but the maintenance can be but a couple hours a month or less, and, unlike fish hobbyists, you won't have to feed your plants every day! Also, tanks and terrariums can be kept almost anywhere in the home, school, or office. I strongly suggest you consider cultivating the plants under grow-lights, as recommended on page 15.

There are several ways of growing CPs in tanks. Although the traditional terrarium may be the first to come to mind, this old-fashioned, soil-at-the-bottom-of-an-aquarium style may not necessarily be the best. One drawback is that variety may be limited, since some plants may require a dormancy while others do not. Another problem is that some plants may spread through root or seed growth and become a weedy mess. Still further, setting up and redoing a terrarium can be a sloppy ordeal, and if one plant succumbs to disease or pests, the whole terrarium may soon follow suit. Finally, some of the plants you may wish to grow in your terrarium may require somewhat different cultivating techniques than others. A Mexican butterwort, for example, needs a somewhat drier winter and different soil than *Cephalotus*.

The next section deals with a few basic terrarium styles, moving from the easiest to the most difficult to maintain.

Greenhouse-Style Terrarium

This is my favorite method of growing CPs in tanks. Basically, you take an empty aquarium, sit fluorescent grow-lights along its glass-covered top, and grow the plants in pots that sit in individual water saucers.

There are several reasons why this method is superior. The first is variety. Kept in individual pots and saucers, you can grow *Nepenthes* in their preferred soil mix, while rainbow plants grow alongside in a completely different medium. You can grow temperate plants with the tropicals most of the year, but can easily remove a Venus fly trap or purple pitcher plant during the winter and place it elsewhere for its dormancy. Should aphids suddenly appear on a sundew recently added to the tank, it can be promptly removed and treated before the pest spreads to other plants.

A greenhouse-style terrarium at the author's home. ***Left to right, back row: Nepenthes carunculata, Pinguicula moranensis x ehlersai, Nepenthes tenticulata, Heliamphora nutans, Nepenthes macfarlandi, Drosera extrema, Nepenthes spathulata. Front row: Byblis liniflora, Drosera adelae, Drosera capensis "alba," Drosera aliciae, Utricularia livida, Pinguicula agnata*** **and** ***Drosera capensis "red."***

Keeping the potted plants in individual saucers allows you to maintain the wetter/drier cycle some plants may require, such as Mexican butterworts. Also, species such as *Byblis liniflora, Cephalotus,* and the *Nepenthes* would not appreciate water-logged conditions all of the time.

Probably the biggest relief comes at cleaning time. Large and heavy tanks can be an ordeal to clean when the algae and splashed soil particles become unsightly. Using the saucer method will make cleaning the tank much easier.

The third benefit of the saucer method for the greenhouse terrarium is that lower-growing plants like rosetted sundews can be raised closer to the lights by placing the pot and saucer on an empty, upside-down pot, or some other pedestal. Further, plants with larger drooping or pendulous leaves, such as forked sundews or *Nepenthes,* will be shown to a better advantage with the pedestal method. Your basic square or circular green plastic pots work well here, or you may choose an opposite approach and grow the plants in a variety of ceramic, glazed pottery.

A SUBTROPICAL GREENHOUSE-STYLE TANK

Plants should be kept in individual pots; on a twelve- to sixteen-hour photoperiod; minimum temperature 45–55 degrees; maximum temperature 75–85 degrees. The following plants do well:

Highland *Nepenthes* varieties, Cape sundews, rosetted subtropical sundews, such as *Drosera aliciae, D. spatulata, hamiltonii, venusta,* and *anglica* "Hawaii". Tropical sundews such as *D. adelae, D. schizandra, prolifera,* and *D. intermedia* "Tropical Form". Forked sundews like *D. extrema* and *D. x marston dragon.* Most pygmy sundews. All Mexican, subtropical, and warm-temperate butterworts. *Byblis liniflora. Heliamphora* species and hybrids. *Cephalotus.* Subtropical terrestrial bladderworts, such as *Utricularia sandersonii, U. livida,* and *U. calycifida.* Tropical epiphytic bladderworts such as *U. longifolia, U. alpina,* and *U. reinformis.*

The above-mentioned plants do not require cold dormancies and most will generally be attractive year round. It is best to reduce the photoperiod to twelve hours in winter, gradually increasing the period to between fourteen and sixteen hours in summer. This will usually keep flowering times on schedule and also trigger winter rosettes in the Mexican butterworts and gemmae production in pygmy sundews.

HEATED, GREENHOUSE-STYLE TROPICAL TANKS

When warmed to a minimum of 60–70 degrees, the following plants do well. Photoperiod should be twelve to sixteen hours. Lowland *Nepenthes* varieties, Mexican butterworts, *Genlisea, Byblis liniflora,* Tropical sundews such as *Drosera adelae, D. schizandra, D. prolifera, D. petiolaris,* and *D. indica* varieties. Tropical epiphytic bladderworts such as *Utricularia longifolia, U. alpina,* and *U. reinformis.* Tropical terrestrial bladderworts such as *U. pubescens* and *U. calycifida.*

The Potted-Landscaped Terrarium

This method is rather similar to the above except that the space between the pots are filled with fine orchid bark, lava rock, perlite, pumice, or mosses to give the appearance that the plants are planted in soil. Long-fibered sphagnum makes a good medium to use for this method, and live sphagnum growing along the surface can be rather attractive. Trimming the live moss will be necessary to prevent it from overgrowing some of the shorter potted plants. One can also use orchid bark, pumice, lava rock, or perlite as a base to hide the pots, with sphagnum as a top-dressing, although the whiteness of perlite may be distracting. You can still keep the plants in individual saucers, but it is easier to set them on a base of moss, pumice, lava rock, or bark, and then raise or lower the base as would suit the plant's wetness or dryness requirements. The water table would be visible through the glass.

It can be fun to decorate a tank with this method. Raised pots of *Nepenthes* can be hidden with Spanish or sphagnum moss draped along its exterior. Potted bog grass, orchids, or ferns can make the tank more natural-looking. I like to set mossy branches, rocks, and *Tillandsia* air plants along the soil surface of such a tank, giving the appearance of a tropical jungle even if the plants are not native to such an environment. Although lethal as a growing medium, decorative or green sheet mosses can be used as a soil dressing as well.

When the plants are kept in individual pots, you have the advantage of moving them around, as with the greenhouse-style tank. Cleaning out and redoing the whole tank would be necessary—usually every one or two years.

There are four things to consider if you wish to make your terrarium more attractive and easier to maintain. One is to attach your grow-lights to a timer, so they will go on and off without your having to be around. The second is to keep your tank ventilated. This means having an air gap of one to two inches along the top of the tank to allow good air circulation. A constantly steamed-up tank with an overabundance of humidity and stagnant air is a sure invitation to mold and fungus. A third important suggestion is to line the back and sides of the tank with a reflective material such as Mylar, white cardboard, or mirrors. This will greatly enhance the strength of light upon the plants and

color them up beautifully. Some growers place a removable reflector on the front of the tank, removing it when they are home or wish to view the plants. This will cause the light to bounce around the tank, and the vivid colors of the plants—even some distance from the grow-lights—will take your breath away. Finally, I like to keep a spray bottle of purified water near the tank. Giving the terrarium a heavy mist in the morning and evening will increase humidity and circulate the air.

The Classic Terrarium

Despite its limitations, the classic terrarium, where plants are grown in soil at the bottom of an aquarium, is still a feasible way of growing some CPs. The most important thing to remember is that your selection of plants should be of a variety that share a similar soil and climate in their wild habitat. In other words, don't mix temperate Venus flytraps and tropical pitcher plants, since not only do they come from differing climate zones, but their soil requirements are rather different as well.

A habitat terrarium is a fun idea. In this type of tank you would choose plants that grow in the wild together, such as a southeastern U.S. savanna. Typically, this is easy to set up: on the bottom of the terrarium, lay two or three inches of horticultural sand, pumice, lava rock, or charcoal. This will allow good drainage and a visible water table. On top of this, place a layer of premixed and wetted peat moss and sand; about a fifty-fifty ratio is good. Sloping the medium is a wise idea, so the water-loving plants can be placed in the lower portions and better-drained plants in the upper or higher grade of the medium. Usually, three to six inches of soil is good for most plants.

In a temperate terrarium such as this, when grown under artificial light, remember to fluctuate the photoperiod between winter and summer as discussed on pages 13–14. Also, dormancy will be critical in winter (see page 14); the tank should be moved to a cooler room, outdoors to a covered porch or patio, or to a garage window.

Permanent indoor terrariums, grown under artificial lights on a twelve- to fourteen-hour photoperiod, are more suitable to subtropical CPs. In a similar peat/sand soil, you can grow Cape and rosetted sundews, *Cephalotus,* some Mexican butterworts, and rainbow plants, although the latter three varieties will need good drainage. You could also scoop out some of the peat and sand, replacing it with a pocket of *Nepenthes* soil for better drainage, and try tropical pitcher plants there.

Some *Nepenthes,* such as *N. mirabilis,* often tolerate swampy conditions in the wild.

A word of warning, however. Some plants in a classic terrarium may run wild if left unchecked. *Drosera capensis* will produce so much seed that if the flower stalks are not removed, cape sundews will come up in the hundreds within a year. Some terrestrial bladderworts, like *Utricularia livida,* will spread in months throughout the whole tank until it is a mass of lovely flowers—but you may not see much else in your terrarium! Trimming the flowers will do these plants no harm.

TEMPERATE CLASSICAL TERRARIUM

Use a soil base of half peat to half sand. Photoperiod should be reduced to eight hours in winter, with cool temperatures: 40–60 degrees. By summer, increase the photoperiod to sixteen hours with temperatures of 60–90 degrees. The following plants do well:

Venus flytraps, low-growing American pitcher plants such as *Sarracenia purpurea, S. psittacina, S. rubra,* and the smaller hybrids. Warm temperate butterworts such as *Pinguicula caerulea, P. pumila, P. lusitanicum, P. primuliflora, P. lutea.* Terrestrial bladderworts such as *Utricularia subulata* and *U. cornuta.* Temperate sundews such as *Drosera rotundifolia, D. intermedia, D. capillaris, D. filiformis.*

As mentioned, this type of terrarium is difficult to maintain due to the often chilly to cold temperatures the plants require during their winter dormancy or rest period. Many subtropical plants will also succeed in such a tank if temperatures do not drop below freezing.

Heating a Terrarium

Should you desire to grow lowland tropical CPs in a tank, it is best to supply a heat source so the minimum temperature is maintained at roughly sixty to seventy degrees. To accomplish this, visit your pet shop. A simple way to heat a terrarium is to place an aquarium heater in a

large jar of water and set this in the tank (the jar can be disguised with decorative mosses). Set the thermostat between eighty and ninety degrees. The warm water will also provide additional humidity.

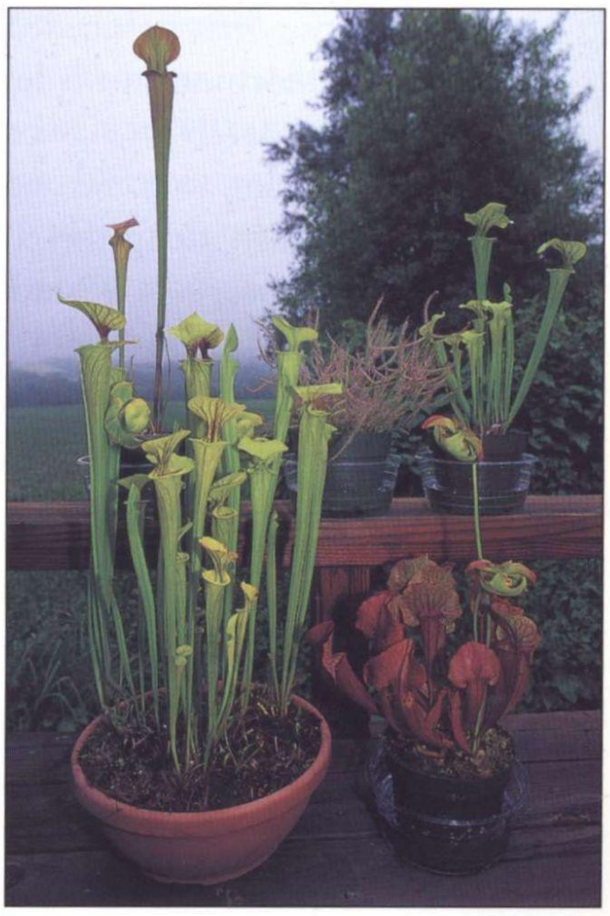
Alternatively, various heating pads and "hot rocks" can be used to warm a greenhouse-style terrarium, particularly those designed for reptile habitats. The pads can be placed under the tank. The thermostat should be set at around seventy degrees minimum.

Growing Carnivorous Plants Outdoors

Since carnivorous plants are so exotic looking, many people assume they are all tropical in nature, which of course is far from the truth. Since there is a wide variety of CPs from various different climates of the world, chances are you live in an area where some, if not many, can be grown outdoors. Furthermore, some CPs, such as the popular Venus flytrap, can often grow better outside than inside, even if you live in a climate with cold winters. It is startling to realize that you would probably have better luck growing the flytrap outdoors year round in New York City than you would if you lived in Key West, Florida.

In Part Three of this book, we will explore the specifics of which species will grow where. Here I will give a basic overview of what carnivorous plant enthusiasts have discovered over the years. This information is, of course, quite general, and most of it from the United States. The terms I use for climate zones are defined on page 57.

Unless you live in a swamp, carnivorous plants grown outside will always be container plants. See the sections on the tray system and pottery and containers (pages 10–11) for



Many carnivores thrive on decks and patios as container plants grown on the water tray method. *Upper rear, left to right: Sarracenia flava* "coppertop," *Drosera binata, Sarracenia oreophila. Lower front:* A garden bowl of *Sarracenia flava, Sarracenia (purpurea* x *flava)* x *flava.*

more detailed information. Growing CPs outdoors is not much different than growing the plants elsewhere. The simple rule is that once you have a plant in its proper location, all you have to do is keep it watered well, and occasionally weed and trim it.

Direct sun is important to most carnivorous plants. How much direct sun will depend on the plant and where you live. As a rule, if you live in an area of high humidity, full sun will cause most CPs to become colorful and robust. Outdoors in a place like humid North Carolina, American pitcher plants, Venus flytraps, and warm temperate sundews and butterworts (all native to the southeastern United States) thrive in sunny conditions, as witnessed by the attractive bog garden displays at the North Carolina Botanical Gardens in Chapel Hill (see photo on page 52).

But if you live in California, where hot summer days often reduce the humidity to 50 percent, 40 percent, 30 percent, and even lower, some protection may be needed to keep up the appearance of your outdoor plants. Morning sun is less harsh than that in the afternoon, and screening on a porch or a cover of shade cloth will also soften the often burning afternoon rays. Strong sun combined with low humidity will cause nectar burn along the edges of trumpet plants, and may evaporate the gluey drops of a sundew. Also, water evaporation from trays and saucers can be startling. In short, if you live in a hot and dry area, CPs will benefit from morning as opposed to afternoon sun, possible protection by screening or shade cloth, and a lot of water. On hot days you may have to fill a deep water bowl up to the surface of a pot and replenish this in a day or two, as the lower humidity will evaporate the water very rapidly.

This may not be the case if you live on the coastline of a Mediterranean-like climate. California, with its numerous microclimates, can be sixty-two degrees and foggy near the beach, yet just fifteen miles inland, east of the coastal range, temperatures can be in the nineties and hot and dry. Consider your own climate when deciding where you can grow your plants outdoors.

Certainly the opposite should also be a consideration. A white trumpet plant, *Sarracenia leucophylla,* is adapted to the warm and humid summers of the Gulf coast, where it is native. If you live in Seattle or right against the Pacific Northwest coastline, *S. leucophylla* may not do very well, as the summers are often cool, foggy, and overcast. You may

want to choose a sun-trap area outdoors, such as a courtyard or against a sunny exterior wall. Or better yet, build a small cold frame to house your plants, to allow the greenhouse effect to warm them.

Indoors/Outdoors

Let's say you live in Germany or Wisconsin. You want to have a nice pot of Venus flytraps, Cape sundews, or hooded pitcher plants on your sunny patio table. But your winters are too cold to grow them outdoors year round. No problem.

Venus flytraps and American pitcher plants are dormant and rather unattractive for a few months in winter anyway. They need a chilly winter, but not as cold as Wisconsin's or Germany's. Cape sundews, native to South Africa, can survive a light frost but don't require a dormancy. You can still grow these plants outdoors much of the year simply by moving them indoors for winter. Cape sundews, or other subtropicals that grow year round without a rest period, can be moved indoors to a sunny, south-facing window when the first frosts threaten in early autumn. Warm temperate plants such as flytraps can be moved indoors before the first severe freezes begin. Just remember that a Venus flytrap requires a cool dormancy. Don't place this plant on a warm, sunny windowsill in winter—you will force it into growth out of season, which will eventually exhaust and may kill it. Instead, choose a cool room, garage windowsill, or porch, out of excessive winter sun, and keep the plant there for its dormancy. Minimum dormancy should be around three months.

The Cold-Hardiness of Warm-Temperate Plants

More experimentation is needed to find out just how cold-hardy some CPs really are. But as hopeful examples, let me mention some extremes I have heard about as a nurseryman and long-time CP grower.

Venus flytraps are native only to the Carolina coastline, yet plants have been introduced and have succeeded for many decades in bogs 500 miles to the north, in New Jersey.

American pitcher plants such as *Sarracenia flava* and *S. rubra* have been successfully introduced near Vancouver, Canada, as well as eastern Pennsylvania. Published accounts indicate that outdoor bog gardens in Vermont, planted with CPs native to the southeastern United States, have survived for twenty years, with mulching for protection in winter.

A customer of my nursery once told me that in Ohio for many years he had an outdoor bog garden planted with southern CPs. Every winter, despite a heavy mulch of hay, the soil of his garden rose out of its container like a block of ice, yet all *Sarracenia* and *Dionaea* survived. In such northerly climes, the plants may not grow as fast or produce as many offshoots as in areas of longer summers, but still can grow surprisingly well.

A woman in Dallas kept her plants in pots outdoors on a patio. One winter the temperature briefly hit ten degrees. Her Venus flytraps and American pitcher plants survived, and her cape sundews returned in spring as a result of their thick roots, but she did lose a pot of Australian forked sundews *(Drosera binata)*. Even her South African bladderwort *(Utricularia livida)* survived.

***Drosera capensis* "alba" two months after a 24°F freeze. New plants are emerging from the older dead stem.**

Atlanta Botanical Gardens has outdoor bog gardens of CPs native to areas somewhat warmer than northern Georgia. Brief lows near zero degrees left flytraps, pitcher plants, and other warm-temperate species unharmed.

Remember that the duration of deep freezes can be a deciding factor on the cold-hardiness of CPs. Brief drops near zero degrees may not kill a Venus flytrap if temperatures quickly rise, but many weeks below freezing may lead to a plant's demise. Also, plants in a bog garden survive freezes better than in exposed pots.

In Part Three on genus cultivation, I will offer more information on the cold-hardiness and heat tolerance of different species of CPs.

Tropical CPs Outdoors

If you live in a tropical climate, you can certainly grow CPs native to similar areas as outdoor container plants. Most growers report that

plants such as *Nepenthes* thrive in sunny areas, but do best when protected with shade cloth from the hot tropical sun.

Altitude plays an important part in the temperature range of tropical climates. You will have better luck growing lowland *Nepenthes* outdoors if you live in a low-lying tropical region. However, if you live on a mountain above three or four thousand feet, where night temperatures can cool considerably, highland *Nepenthes* will be a better choice than the lowland varieties.

Growing warm temperate plants in highland tropical climates is also possible. People living in Hawaii, on the edge of the tropical zone, can often succeed with Venus flytraps and *Sarracenia* outdoors if they live in a cooler, high-altitude region. Folks in the lowlands may have to bare-root such plants and store them over winter in the refrigerator.

Subtropical climates, such as Miami, and warm temperate Mediterranean-like ones, such as San Diego, rarely see frost. Yet the climates are rather different in another way. The latter city will experience cool nights year round, even when summer days are warm. Highland *Nepenthes* thrive in such weather and can be successful outdoors, but only near the humid coast. Yet only lowlanders would survive the hot summer nights of Miami. In both places, it is wise to bring the plants indoors when a cold snap is predicted. Tropical *Nepenthes* may slow down or stop growing during the cooler winter months, but usually become vigorous as the weather warms up.

There are a few *Nepenthes* that have been found to be surprisingly cold hardy. I have found that *N. khasiana,* one of the most cold-tolerant tropical pitcher plants known, can tolerate brief temperature drops into the twenties without damage, when protected overhead from frost. Large *N. khasiana* returned to health after a freeze of fifteen degrees.

Some tropical sundews are also frost hardy. *Drosera adelae* has been known to return from its roots after light freezes in the San Francisco area.

Savage Gardens

Carnivorous plant bog gardens can be a center point of drama and intrigue as well as beauty. Artificial bogs can be large or small. They can be placed in the ground, so as to appear natural, or constructed in a container as a dish garden for the deck or patio. Even greenhouses

can be the home of such a savage garden. Provided you have enough pure water to keep the bog wet, its maintenance can be simple for many years, requiring only basic weeding and trimming.

The plants you can grow in an outdoor bog garden will be primarily the same as the plants your climate allows you to grow outdoors year round. Greenhouse bogs will naturally offer protection in harsher weather, and smaller containers or minibogs can be moved about should protection be needed. Even in cold-temperate climates, larger bogs that are in the ground can be protected from extreme temperatures by mulching during winter dormancy, allowing plants to be grown far from their native habitats. There is even a method of growing individual carnivores in a mixed, noncarnivorous garden setting, as in a rock garden or one consisting primarily of cacti and succulents.

The Outdoor Bog Garden

Setting up a bog garden outdoors is not unlike, but much simpler than, constructing a small pond. Instead of water, the container is filled with a wet mixture of peat and sand. There are two methods of construction. The first is to dig a hole conforming to the dimensions you wish your bog to be. Its depth should be a minimum of about ten to twelve inches. Deeper bogs will hold more water, so may require less watering in drier climates. Its width should be of a size so that the center is easily accessible from the bog's edge. Very wide bogs can be later garnished with stepping stones to make access to the center easier. Remember, you won't be able to walk in your bog to weed or trim plants later.

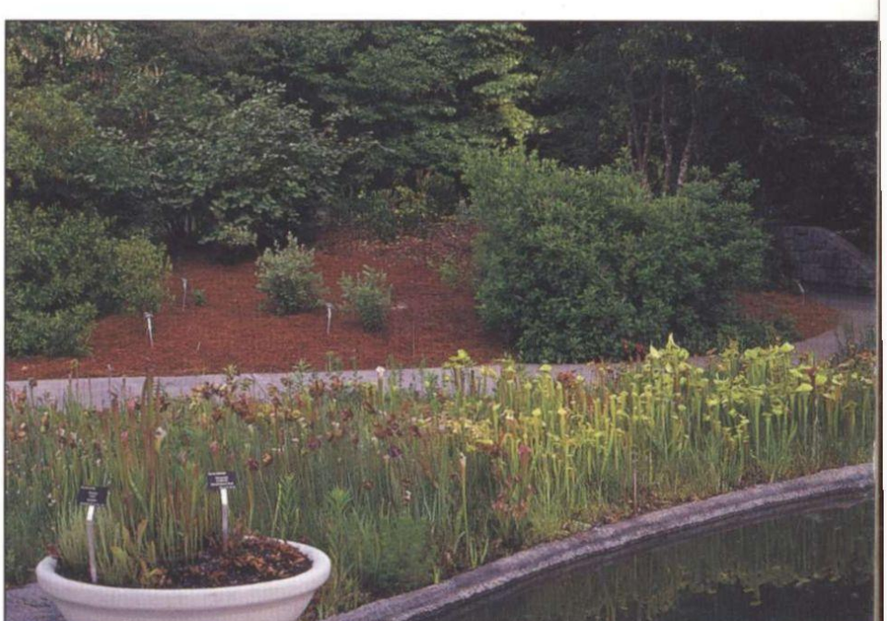
Raised bog gardens beautifully display the collection at North Carolina Botanical Garden, Chapel Hill.

This shallow hole is then lined with sheet plastic. It is best to use actual pool or pond liners meant to hold water. They are much more durable than greenhouse sheet plastic. If the ground soil is very rocky, you may want to

place a thin layer of sand or dried peat along the dimensions of the hole, so that small, sharp rocks or pebbles won't pierce the liner when it is weighted down with the bog's soil. Liners that overlap the bog's edge can be trimmed and later covered and decorated with rocks.

You should not construct a bog in depressed areas of your property where there is a risk of flooding during heavy rains. Also, I like to put several holes in the liner around its periphery, around two to three inches below the surface of the bog's soil. This will allow drainage of excess water after heavy rains, so plants won't be permanently waterlogged.

The second method for setting up a bog garden is somewhat simpler. Instead of a pool liner, one can use a prefabricated container such as a children's wading pool or a molded plastic pool designed for a small pond or water garden. Water gardens have become so popular in recent years there are many intriguing shapes, sizes, and designs available at nurseries and garden centers. Simply excavate a hole to accommodate the molded pool and set it into the ground. Again, I recommend drilling a few drainage holes into the sides.



Bogs and mini-bogs border a pond at Atlanta Botanical Gardens.

The peat and sand should be of equal parts, and premixed with water before you add it to the bog container. Be sure to pack it firmly. I also like to vary the depth of the surface, so that you have well-drained mounds and wetter low areas to better suit the individual species' preference. It is often fun to have a shallow depression in the bog, where water will be permanent, so as to grow aquatic bladderworts or *Aldrovanda* there. In very large bogs, you may want to have a shallow moat of water encircling the whole garden, to bar access of certain crawling pests such as slugs and snails. Aquatic carnivores or other water plants can then be grown in the moat.

Once the soil is in the garden and packed firmly, planting can begin. If you use potted plants, a bog garden can be planted at any time of the

Another view of the stunning and savage gardens at Atlanta Botanical Gardens.

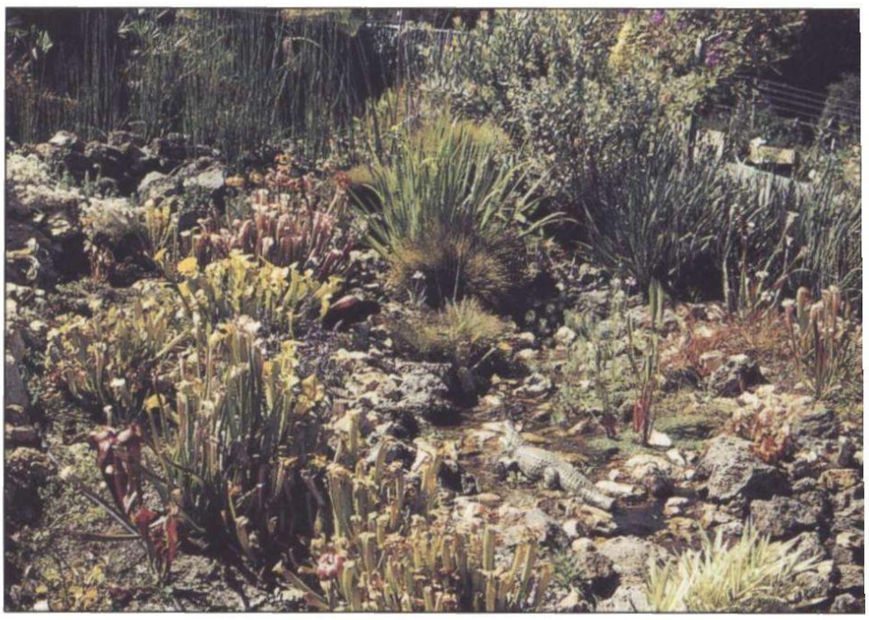
year. If you obtain bare-root plants for your bog, it is best to set this up in the late winter or early spring as the plants are coming out of their dormancy.

Designing the layout of your bog will take foresight. If your garden is to be viewed from all sides, it is best to group taller plants toward the center, such as trumpet plants. Smaller varieties, such as Venus flytraps, parrot pitcher plants, and sundews are best along the outer edges. If you place your bog so it is viewed primarily from one side, such as against a fence, taller plants would naturally look best toward the back, gradually terracing the smaller varieties towards the front. Keep in mind the species' growing habits. A single crown of a sweet trumpet plant, *Sarracenia rubra,* can spread into a large dense mass in a few years. *Drosera binata,* likewise, can spread through its root system. You might consider growing such plants in a porous container within the bog, such as peat pots or cloth bags, but these in time will deteriorate anyway, and most people prefer their plants to spread.

The species of plants you can grow in a bog garden of this type will naturally be the same as those found naturally in a peat-based soil. You could not grow *Drosophyllum* in such a bog, for example. Most enthusiasts enjoy growing a wide variety of carnivorous plants in such a garden, such as *Sarracenia, Dionaea, Drosera, Pinguicula, Cephalotus, Byblis,* and *Utricularia.* But equally stunning are theme bogs, such as a garden of all trumpet plants, either all one species or mixed, including hybrids. Alternatively, a low-growing bog can be just as impressive, using species such as *Sarracenia purpurea* and *S. psittacina, Dionaea,* rosetted *Drosera,* and temperate *Pinguicula.*

If you live in Connecticut, yet want to grow warm-temperate species from the Florida panhandle or elsewhere, you can protect the bog in winter. The fact that it is set in the ground will automatically offer some protection, but you should take further precautions: After the autumn

equinox, as the plants go dormant and the first hard frosts occur, trim off their old leaves so that most of the taller foliage is removed. Then scatter several inches of a mulch that is later easily removed, such as pine needles or hay. Now cover the bog with a large sheet of plastic or burlap. You can secure this with stone or, if your winters are particularly severe, cover the plastic with a mound of mulch around twelve inches deep. A blanket of snow will insulate the bog even further.



Bog pockets along an artificial stream in a mixed garden in northern California

After winter, when the last of the severe frost dangers are over, the coverings can be removed. Some plants that do not form true winter resting buds, such as the short-lived *Drosera capillaris* or *Pinguicula lusitanica,* will probably have died off. Such varieties usually return from, or can be reintroduced by, seed from the previous season.

NONCARNIVOROUS ADDITIONS

Noncarnivorous plants can make attractive additions to the savage garden. You can check with your local nursery or water garden specialist for wet-tolerant plants to add to your bog. Ornamental grasses, in particular, make handsome contrasts. Below are some suggestions. Most of these plants are native to the damp pinelands of the southeastern United States.

Yellow-eyed grass *(Xyris baldwiniana)*
Pipewort *(Eriocaulon compressum)*
Shoe button *(Syngonanthus flavidulus)*
Bog buttons *(Lachnocaulon anceps)*
Grass pink *(Calopogon tuberosus)*
Rose pogonia *(Pogonia ophioglossoides)*

Yellow star grass *(Hypoxis hirsuta)*
Coneflower *(Rudbeckia graminifolia)*
Comfort root *(Hibiscus aculeatus)*
Bay blue-flag *(Iris tridenta)*
Japanese blood grass *(Imperata cylindrica 'Rubra')*
Teena turner grass *(Isolepis cernuus)*
Disa orchids from South Africa

Carnivores in a Mixed Garden

Carnivorous plants growing among cacti and succulents, ornamental grasses, or in a rock garden can be rather startling. Yet this is easily accomplished if you grow carnivorous plants in undrained containers that are set into the ground. I like to use large plastic pots that have no drainage holes, such as the ones that floral shops use to store cut flowers. Plant your carnivore in such a pot with its preferred soil mix, then dig a hole in your garden to accommodate the container and set it into the ground. The rim can be disguised with rocks or mosses. Be sure you water the CPs frequently and separately from your other garden plants. Avoid using sprinklers on the CPs if your tap water is hard, or protect them by covering them with small patches of sheet plastic when you water.

Long, rectangular containers set in the ground along a sidewalk can be planted with rows of *Sarracenia* trumpets for an unusual and effective border. Circular plastic garden bowls planted with a mass of cape sundews, Venus flytraps, or flowering terrestrial bladderworts can be the center point of a mixed "alpine" rock garden. If your climate permits, a drained container of climbing *Nepenthes* can be set in the ground among small palms and ferns for an unusual tropical effect.

The Minibog

Miniature carnivorous plant bog gardens are one of the most popular and simple ways to grow CPs. These are set up in the same way as larger, in-the-ground artificial bogs. The only difference is that you'll use smaller, freestanding containers. These can be grown on sunny decks, patios, or balconies. If you live in a climate with harsh winters, the containers can be moved to bright garage windows or basement

windows for the winter to accommodate the bog's dormancy, if needed, or into a sunroom if the plants grow year round.

Containers for minibogs? You can use a wide variety of plastic garden bowls for this purpose, or even wine barrels or wooden planter boxes that are lined with sheet plastic under the soil (remember, the container needs to be undrained). Wooden window boxes lined with plastic and planted with forked sundews or pitcher plants certainly draw more attention than geraniums, and snares houseflies before they come through the window!

A visit to your local weekend flea market can often be a source of fabulous and unusual minibog containers. Undrained, glazed ceramic flower pots, urns, bonsai dishes, salad bowls, large ashtrays, water basins, and cut flower vases are just some of the possible containers in which to grow a minibog. The smaller containers can be ideal for tiny bogs of miniature plants: pygmy and rosetted sundews, short-rooted butterworts, terrestrial bladderworts—all do well in shallow containers. Larger and deeper containers can be planted with a similar variety of CPs as a sizable in-the-ground bog garden, but on a smaller scale.

Jana Olson Drobinsky's intriguing mini-bog in an antique tub

For many years, I grew the following in a fourteen-inch, plastic garden bowl: *Sarracenia rubra* ssp. *wherryi, S. flava,* and *S. psittacina; Drosera capensis, D. spatulata, D. filiformis ssp. tracyi,* and *D. nitidula* x *occidentalis; Utricularia livida;* plus a clump of yellow-eyed grass.

An interesting variation on the minibog is the miniature island bog. In this setup, I use a plastic garden bowl with a removable plug, which I discard. I cover the hole with a handful of long-fibered sphagnum to prevent the leakage of soil. Then I fill the container with a peat-and-sand mix, and plant it as I would any other minibog. I then set this container

An inexpensive plastic urn is the perfect home for *Sarracenia* x *readii*, *Sarracenia purpurea* "red form", *Drosera capensis* and ornamental grasses.

into a similar but much larger garden bowl, leaving the plug intact. This larger container then acts as the water tray, and I keep the water fairly deep most of the time. Not only will this method allow for less watering stress, but the moat around the minibog will act as a barrier to slugs and snails. Further, the moat becomes the ideal place to grow aquatic carnivores such as *Utricularia gibba* or *U. purpurea,* or the waterwheel plant, *Aldrovanda.*

Bog Gardens in the Greenhouse

Although the most common way to grow CPs in the greenhouse is to set potted plants into water trays or saucers, a bog garden is certainly an option. You could, if you wish, put a bog garden into the ground of your greenhouse as you would outdoors. But it is much easier to construct a tableau or boxed bog garden right on the benches or staging of the greenhouse.

You could use a prefabricated plastic container such as a wading pool and set this upon your greenhouse bench, but it is often cheaper to construct your own. A simple way is to make a rectangular wooden frame out of 8 x 2-inch boards. I like to use a sheet of plywood as the base. This box is then lined with a sturdy, 6 mm sheet plastic, stapled along the interior. Simply fill the box with your soil mix of pre-wetted peat moss and sand, and landscape as you would any outdoor bog garden. Depending upon the size of your boxed container, features such as *Utricularia* puddles or moats can also be added, just as with outdoor gardens.

GROWING CPs OUTDOORS

The following terms referring to climate zones will be found throughout this book. Temperatures are given in Fahrenheit.

Cold-temperate: Warm summers, with very cold and long winters, with temperatures below freezing lasting for many days at a time.

Temperate: Warm summers, with winters having many cold snaps, usually of brief duration and not below 22 degrees, although colder temperatures may rarely occur.

Warm-temperate: Warm summers, with occasional cold snaps of short duration usually not below 28 degrees, although colder temperatures may rarely occur.

Subtropical: Warm summers with mild winters. Occasional cold snaps, but rarely below freezing, or 32 degrees.

Tropical: Few temperature extremes, but no freezing temperatures expected.

Highland tropical means warm days and cool nights. Lowland tropical means hot days and warm nights.

Mediterranean-like: Warm, dry summers and cool, wet winters. May be temperate, warm temperate, or subtropical. Cool Mediterranean-like climates have cool but dry summers.