

North Carolina Native Plant Propagation Handbook

Second Edition
February 25, 2001

North Carolina Wild Flower Preservation Society

Dedication

The purpose of the North Carolina Wild Flower Preservation Society is to promote awareness and conservation of our native plants. This handbook is dedicated to that ideal. This second edition builds on the work of our Society founders who recognized the need to assemble their various native plant propagation notes and methods to produce a volume of shared expertise. The aim then, as now, was to promote the preservation and cultivation of native species through propagation.

At the time of the development of the original manual many native species offered to the public for sale were collected from wild populations, often with disastrous results. In many cases both the native populations and the plants collected failed to survive this commercial assault. It was recognized that reducing collecting pressures could help preserve the native populations. One way to do this was to develop propagation procedures that would allow plants to be produced in nursery conditions. This allows many more people to learn more about the cultivation requirements of unique native plants and to provide a plant supply and advice to the public.

We dedicate this edition to the NCWFPS members who compiled their records of both success and failure and were able to produce a valuable and useful manual about the propagation of North Carolina native plants. The contributors to both the original and the new edition have shared a wide range of information and expertise unavailable from any other source. It is hoped that the reader will continue to learn about native plant propagation and will share this through the NCWFPS Newsletters and contribute to future editions of this handbook.

We also dedicate this edition to all the nurseries that propagate and promote native plants and those gardeners who appreciate and use natives in their gardens. The pressures on our native plants and their habitats have increased since the publication of the original edition. This edition serves as a reminder that our work to protect and promote native plants is not done, and is needed now more than ever.

Kenneth A. Bridle, Ph.D., Editor
February 2001

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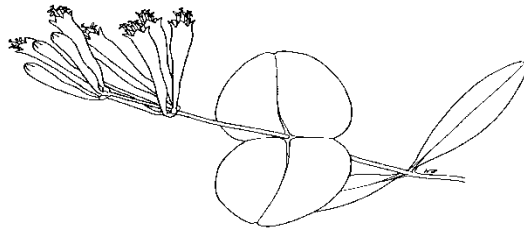


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Section 1: Conservation of Native Plants

The best way to conserve wildflowers is to protect them in their native habitats. The disappearance of these habitats should concern all of us. What should be our response to the destruction and modification of the natural landscape by road building, housing and industrial development, agriculture, silviculture, governmental and private activities, when they have destructive impacts on natural processes? Priority should be given to plans developed to maintain our present natural areas, many of which have been identified and described.

Regulatory agencies should be supported in their attempts to enforce standards now in effect, which protect natural resources. Activities of industrial and governmental groups should be monitored continuously to assure that sound environmental policies are being followed. Regulations now on the books prescribe standards for maintenance of air, water and soil. Few regulations and suggested best management practices apply to plants, both exotic and rare. Also the public has a low awareness of the importance of natural flora resources. Numerous plants protected by North Carolina legislative action currently are being dug individually by hobbyists or by the truckload for commercial gain. The Carolina Mountains are providing significant supplies of wildflowers to meet commercial demands of markets throughout the eastern United States. Several commonly sold species such as Lady's Slipper orchids (*Cypripedium* species) seldom transplant successfully even in the most favorable situations. Lists of rare and endangered species must be continually revised to reflect these losses.

An intelligent, informed and concerned public will help put force into laws necessary to save our natural plant heritage. Individuals should keep in touch with activities of local, State, and Federal agencies engaged in planning activities that might destroy or drastically alter the natural landscapes remaining intact. State and Federal governments have environmental policy agencies responsible for planning large-scale activities, and for reviewing the actions of other agencies. Contact the North Carolina Department of Environment and Natural Resources, 1601 MSC, Raleigh, NC 27699-1601, (910) 733-4984 to inquire about activities that may affect the

environment in your community.

There is great interest at the present time in developing parks, green belts, natural areas and recreational facilities. Citizens should encourage their city, county and state officials to plan and establish such areas. Habitat preservation should be of prime consideration in all situations. Habitat loss is one of the primary reasons for the decline in numbers of many species.

Finally in those cases where wildflowers are endangered or threatened because of site destruction or modification, a positive program of plant removal should be followed. Expert opinion should be sought in these situations from botany departments of local colleges.

The North Carolina Botanical Garden maintains a plant rescue program (Plant Rescue, NC Botanical Garden; CB 3375, Totten Center, Chapel Hill, NC 27599-3375 or phone 919-962 0522) organized by staff and volunteers to deal with these problems and local referrals throughout the state.

Information regarding organized plant rescues can also be found at The North Carolina Wild Flower Preservation Society web-page (www.ncwildflower.org) and at plantrescue@ncwildflower.org

To grow a wildflower is to share the responsibility of protecting our natural heritage. Learn to propagate native plants and then share the joy of cultivating your successes with others. Do not remove rare and hard to grow plants from undisturbed natural sites. Being identified as a collector of rarities such as native orchids, lilies or ferns should no longer be a reputation to be admired. Removing a Pink Lady's Slipper to a probable death in a home wildflower garden can never take the place of seeing one growing in the wild during a spring hike into the woods. Many of the most beautiful wildflowers are neither rare nor endangered and can be successfully grown if reasonable care is provided. Each attempt will be a challenge. Keep good records and share your failures and triumphs with other members of the North Carolina Wild Flower Preservation Society.

Section 2: Cultivation of Native Plants

When cultivating wildflowers, it is important to bear in mind that the new site generally is quite different from the natural site. There are differences in soil structure; amount and kind of organic matter; kinds of associated trees and shrubs; degree of shade; water and nutrient supply, soil pH and temperature fluctuation. Most wildflower growers attempt to provide a habitat as similar as possible to that of the native habitat but exact duplication is not possible. Keep in mind that many plants will tolerate a range of environmental conditions. The crucial period occurs at the time the plants are transferred to their new site. Once the shock of transplanting is over and a vigorous root system is established, the majority of wildflowers respond satisfactorily to the conditions furnished by thoughtful, conscientious gardeners. The challenge will come in trying to understand the requirements of the plants with specific limiting needs.

Site Preparation

Improving Your Site and Creating Artificial Habitats

In cultivating native plants, the best policy is to work with plant material that is most suitable to the land available to you. By careful observation of the sun, shade, soil and moisture conditions of native plants in their typical habitats you will be able to select the plants most likely to offer you success. You will also learn that many North Carolina native plants are restricted in their naturally occurring distribution to the Mountain, the Piedmont, or Coastal Plain regions. In general, characteristic mountain species are best grown in the moist cool mountain counties and the same holds true with species occurring characteristically in the Piedmont and Coastal Plain regions. Species with a statewide distribution are the best for general garden cultivation throughout our state. However, if you are determined to have plants requiring specialized conditions such as bog species, these conditions will have to be provided by site improvement or creation of artificial habitats. It is important to realize that once you create an artificial habitat it may require more careful maintenance than is realistic for your particular gardening schedule. For example, there is

no justification for creating an artificial bog garden if your garden goes unattended for long periods in the summer months when it will require additional generous watering. It is better to return home to drought resistant Goldenrod and Butterfly Weeds than to a drought-stricken bog collection.

The Shaded Woodland Garden

If you are located on a wooded site with a cool north exposure and with humus-rich soil, you have a good location for the most often sought-after native plants, the spring-blooming woodland species such as Trilliums, Geraniums, and Dutchman's Breeches for which our Carolina mountains are famous. The presence of Christmas Ferns, *Polystichum acrostichoides*, on your site is a good indicator that you have a good location to try a woodland collection. Without such an ideal site available, one's work is considerably increased. The first requirement is a source of shade, whether it be a pine or deciduous wooded site, or the shaded north side of a dwelling.

The next consideration is soil improvement. The sandy soils of the Sand Hills and Coastal Plain require quantities of peat moss, humus or the organic rich material of backyard compost, to add natural soil conditioners and increase soil water retention. The various clay soils of the Piedmont and Foothills will require the addition of large quantities of peat, old sawdust, bark chips, or other humus material to provide good organic content and drainage.

Though it sounds contradictory, our popular mountain woodland wildflowers and shrubs require good drainage as well as generous amounts of moisture. The best way to achieve this condition in heavy clay soils is by establishing raised beds. Raised bed can be created by using timbers or logs as borders and filling them with 8 or more inches of soil. On a wooded home site, the logs may serve to outline a path or trail system while providing a base to hold your raised beds 6 to 12 inches above ground level. Turn over the clay soil to a depth of 12 to 18 inches, the deeper the better, and add at least 6 to 12 inches of humus or rotted sawdust. Make the surface white with a light coating of bone meal (good for plants with bulbs and rhizomes) and yellow with cottonseed meal (good for acid-loving plants that characterize the majority of N.C. natives) and finally mix the different layers uniformly and cover with a pine or shredded leaf

mulch. Fresh sawdust can be used as an additive if old decomposed sawdust or leaf compost is not available, but more generous applications of nitrogen supplying fertilizers will be needed since fresh sawdust "robs" nitrogen from the soil as it goes through its own decaying process. Here, as with all of your garden activities, initial and periodic soil testing and analysis will aid you in determining the amount of nutrients needed to supplement your beds at any given time. You can get data on your own soils with your own kit or through the services of the North Carolina State soil testing service. Remember that your raised beds with porous soil will have the necessary drainage but will require supplementary watering during dry periods.

In locating your raised beds in the woodland setting, don't be afraid to eliminate some trees and shrubs; you'll need the space for additional native species of your choice. Also, be aware that maples, redbuds and dogwoods have surface roots just below the top level of soil and are vigorous competitors for the nutrients and moisture in the soil. Remove these species or avoid planting under them. Also, remember that when you dig your bed, you will be disturbing and destroying some of the root systems of the nearest trees. Also, as much as six inches of soil covering the normal surface of any tree's root system is enough to weaken or kill the tree.

Your raised beds and hillside woodland gardens can be enhanced by addition of rocks. For a realistic effect, most of the rock should be buried in the soil iceberg-fashion and the plants selected for the rock garden will look much better with this rock installation. Sunny rock gardens can be prepared in similar fashion. Bear in mind that some species fully exposed to the sun at high mountain elevations most likely will not survive in equally sunny situations at lower altitudes in the piedmont and coastal plain due to increased heat and decreased soil and atmospheric moisture.

The Bog Garden

The main requirement of a bog garden is to have a constant supply of water seeping through the bog or to have a barrier to retain what water enters the bog. There are many interesting and beautiful wetland species worthy of cultivation in this manner.

No definitive statement can be made regarding recommended

soil and light conditions for all bog plants. Keep in mind the native habitat of the plants you intend to grow. In general, plants from coastal plain habitats such as savannas, pocosins and black water river wetlands do well in peat moss or a mixture of peat moss and sand and require or at least benefit from plenty of sunlight. Most will not tolerate a nutrient rich soil. Carnivorous (also know as insectivorous) plants, fall into this category. The presence of sphagnum moss in the natural habitat of the plants you intend to grow is a good indicator that this type of soil mixture is required. For bog gardens using this soil mixture you may wish to get sphagnum moss started. It will create a beautiful green carpet that adds much to the aesthetics of your bog. Plants from river wetland habitats of the piedmont and mountains will do well in a mixture of topsoil and plenty of humus such as peat moss or composted leaves. Sunlight requirements may vary from full sun to light shade.

Bog gardens can be constructed in a variety of ways. One way is to select a fairly level site which doesn't flood with run-off from heavy rains, that also receives enough sunlight to grow the plants you have selected. Excavate a depression to a depth of about 12 inches. Remove or cover sharp rocks and root ends. Line the depression with a layer of roofing paper followed by a double layer of 6 mil plastic sheet. The soil ingredients should be mixed prior to filling the bog to avoid puncturing the plastic liner. Also bear in mind that dry peat moss is very slow to absorb water and should be moistened before adding to the bog to avoid having it float when you add water. Fill the bog with this soil mixture, trim the plastic about 3 inches above the ground and cover the exposed edges with rocks. Then add 2-3 inches more of soil mixture to allow for some drainage and settling, water thoroughly and add plants.

If you have fairly level ground you can also build a raised bed out of 2x8 or larger pressure treated lumber. The bed must be level to avoid having the water run to a low end. Then as mentioned above, line with plastic, fill with moistened soil mixture and water thoroughly and add plants. Children's wading pools can also be used on the surface or sunk into the ground with the rim just above the surface. This provides more protection from winter freezing and sunlight degrading the plastic. Rocks, bricks or wood can be used to protect aboveground pools from solar deterioration and hide the blue color of these pools.

Rhizomatous species like iris can quickly invade your entire

bog, therefore you may want to confine such species to a plastic washtub or pot with no drainage. Shrubs that might get too large for your bog can be treated in the same manner. These contained plants can be sunk into the soil of the garden, arranged in a group or used on a deck.

Plants you once cherished can quickly earn weed status if some preventative measures are not taken. For some species you will want to collect their seeds before they drop or be prepared to dig the resulting plants out to share with others.

During normal years your bog garden will probably not require much watering during the fall, winter or spring. The summer months will most likely require some supplemental watering. Some well or city water contains an excessive amount of minerals or chemicals that can build up to levels that can harm the plants. The tips of the sphagnum moss turn brown indicating a problem with the water quality. A good source of water is rainwater collected in a container from your gutter downspouts. Another often-ignored source is the condensation drain from your air conditioner, which can be collected or piped directly to a nearby bog.

Of the list of suggested bog plants not all require bog conditions. Some will survive or even flourish in soil of average moisture; however, most are more vigorous in a bog situation.



Suggested Plants for the Bog Garden

PERENNIALS

Acorus calamus, Sweet Flag, Calamus
Aletris species, Colic Root
Amianthium muscaetoxicum, Fly Poison
Arisaema dracontium, Green Dragon
Arisaema triphyllum, Jack-in-the-Pulpit
Asclepias incarnata, Swamp Milkweed
Caltha palustris, Marsh Marigold
Chelone species, Turtlehead
Dionaea muscipula, Venus' Fly Trap
Diphylleia cymosa, Umbrella Leaf
Drosera species, Sundew
Eriocaulon species, Pipewort, Hatpins
Gentiana catesbaei, Gentian
Iris prismatica, Slender Blue Flag
Iris virginica, Blue Flag
Lobelia cardinalis, Cardinal Flower
Melanthium virginicum, Bunchflower
Orontium aquaticum, Golden Club
Osmunda cinnamomea,
Cinnamon Fern
Osmunda regalis var. *spectabilis*,
Royal Fern
Parnassia species, Grass of Parnassus
Peltandra virginica, Arum
Pontederia cordata, Pickerelweed
Rhexia virginica, Meadow Beauty
Sagittaria species, Arrowhead
Sarracenia species, Pitcher Plant,
Trumpets
Symplocarpus foetidus,
Skunk Cabbage
Xyris species, Yellow-eyed Grass
Zephyranthes atamasco,
Atamasco Lily

SHRUBS

Amelanchier spicata, Dwarf Sarvis
Cassandra calyculata, Leatherleaf
Cephalanthus occidentalis, Buttonbush
Clethra alnifolia, Sweet Pepperbush
Cyrilla racemiflora, Titi or Leatherwood
Fothergilla gardenii, Dwarf Witch Alder
Ilex coriacea, Sweet Gallberry
Ilex glabra, Bitter Gallberry, Inkberry
Ilex verticillata, Black Alder
Itea virginica, Virginia Willow
Kalmia angustifolia var. *caroliniana*,
Sheepkill
Leucothoe axillaris var. *editorum*,
Dog Hobble
Leucothoe racemosa, Fetterbush
Leucothoe recurva, Fetterbush
Lyonia species, Fetterbush,
Staggerbush
Myrica cerifera, Wax Myrtle
Rhododendron atlanticum,
Dwarf Azalea
Rhododendron viscosum,
Swamp Azalea
Styrax americana, Storax
Symplocos tinctoria, Horse Sugar,
Sweet Leaf
Vaccinium crassifolium,
Creeping Blueberry
Zenobia pulverulenta, Honey-cup

TREES

Chamaecyparis thyoides, Atlantic White Cedar
Gordonia lasianthus, Loblolly Bay
Ilex cassine var. *myrtifolia*, Dahoon Holly
Magnolia virginiana, Sweet Bay
Nyssa aquatica, Water Tupelo
Persea borbonia, Red Bay
Pinckneya pubens, Fever Tree
Taxodium species,
Pond and Bald Cypress

Carnivorous Plant Collections

Contrary to popular belief, most of our state's native carnivorous plants can be grown outdoors without a greenhouse. In fact, such treatment affords better conditions than the average home or greenhouse, since the factors required for winter dormancy, i.e. cold temperatures and short day conditions, are quite nicely controlled by nature without any effort at all. Ignorance of the necessity of these two factors is the most common cause for failure. Using the techniques briefly outlined below, nearly all of our species can be grown in the Piedmont, Sandhills and Coastal Plain, and most can also be grown in the mountains as well.

In North Carolina, we have as natives four or five species of Pitcher Plant (*Sarracenia*), three species of Butterwort (*Pinguicula*), five species of Sundew (*Drosera*) and of course the famous Venus' Flytrap (*Dionaea muscipula*). All of these can be grown as a group planting.

Necessary basic considerations are the need for winter dormancy (mentioned above, but it cannot be stressed too much), a constantly moist, acid, poor nutritive substrate with low salts content, good sunlight most of the day, and high humidity of the level with which we are naturally blessed in North Carolina.

For "potting," some sort of an impermeable container setup is needed to prevent drying out in small plantings. Often the best items to use for very small arrangements are plastic washtubs or other small tanks. For larger ventures, larger plastic tubs designed for use as water garden liners work well. If buried in the ground to the rim many container types are ideal because this will put the roots below frost level and prevent damage, and the surrounding earth will support the tubs as they become brittle with age and thus prevent cracking and the need for frequent replacement. No drainage is required.

The ideal planting medium is sandy peat soil of the coastal plain. With permission you may obtain several bushels of this valuable horticultural material from a construction site. No attempt at an artificial mixture can ever approach this native material. Another excellent substrate is pure sphagnum moss. If you cannot obtain much of the live green sphagnum, it is all right to fill the bottom of your tub with dried sphagnum, but use the un-milled long fiber sphagnum of the nursery industry. Then use the live green sphagnum moss to "top dress" your planting for looks and also for physiological reasons since

the live moss will provide a continually acid, healthier medium throughout the tub. Plant your Pitcher Plants to the crowns, placing the *S. purpurea* among taller plants because they like protection from drying breezes. Since the smaller plants, Sundews, Butterworts and Venus' Flytrap, are likely to be swamped by fast growing coarser species of sphagnum, obtain and plant one of the finer, slow growing tuft-forming sphagnum species in one corner of your tub and place the smaller species of carnivorous plants here. Butterworts like it a bit drier, so put them up on a tuft.

Water is important. High salts content of water will build up and eventually kill off your little bog. A good sign or indicator to watch is the sphagnum itself. If it stays healthy and green and flourishing, your water is all right. If it turns black to brown at the tips, your water is unsuitable. Natural rains will keep most such outdoor tub bogs quite moist most of the year, but during midsummer "dog days," you should supplement with soft rainwater you have been collecting in a barrel from the eaves drain spout.

You may have an opportunity to collect from a bog that is threatened by development, thereby you can obtain much valuable plant material. Otherwise, send for seed from some of the sources available. Many of your carnivorous plants will flower and set seed which you can sprinkle over the bare areas. *Sarracenia* seeds will germinate in the spring after winter's treatment of damp cold (stratification) while seeds of the other species will germinate immediately after sowing in late spring.

With attention to the above details and many others you will learn through experience, native plant enthusiasts can establish a successful yard bog planting and contribute much to the study and ultimate preservation of our irreplaceable carnivorous plants which are rapidly disappearing due to habitat abuse.

The Sunny Garden

Wildflower gardening frequently makes people think of a garden of beautiful spring woodland plants. The later season flowering native plants of open areas, successional fields, meadows and forest edges and roadsides are often taken for granted as undesirable weeds. They go generally unnoticed until meadows of goldenrods and asters are observed in juxtaposition with the fall

foliage displays for which the southern Appalachians are noted. The keen observer, however, is aware that from spring through late fall there is continuous display of wildflowers changing from week to week and from region to region. Many of these wildflowers are very appropriate for inclusion in the cultivated garden.

A sunny boarder or "island bed" using exclusively native plants can be as rewarding as a collection of more commonly grown conventional ornamental plants. In fact, a surprising number of our wildflowers such as bee balm (*Monarda didyma*), New England Aster (*Aster novae-angliae*), cardinal flower (*Lobelia cardinalis*) and various Black-eyed Susans (*Rudbeckia* spp.), to recognize just a few, have been passed down as common garden plants from generation to generation of gardeners. Do not expect that a plant native to the local region will thrive with less care than the more commonly grown ornamental plants. In cultivation, all plants, weather native or exotic, will respond to the particular conditions provided. Some plants are so specific in their requirements that they will not survive in a general garden bed. Many other wildflower species tend to grow much larger than one finds them in nature because the conditions of good cultivation provide more nutrients and moisture and less competition than the plants face in their natural grounds. For instance, Black-eyed Susans (*Rudbeckia*) in cultivation frequently require staking because they grow more robustly than in the harsher conditions of meadows and roadsides. In cultivating your sunny garden you may prefer to keep your favorite traditional garden plants and mix natives in with them. You simply learn what natives are appropriate for your conditions and amount of care. You also will learn from your experience and by reading the numerous good references available, and by asking your gardening friends, who also may be your best source for plants for your garden. Please learn about the native plants you want in your garden. Do not experiment with rare plants or plants known to be difficult in cultivation. Be absolutely certain that these plants have been legitimately propagated in large quantities and you receive careful instructions from a gardener who has succeeded.

Now about that sunny plant-border. Emphasis here will be on the herbaceous species, though you should be encouraged to add native shrubs for a mixed border or perhaps a single specimen here or there for accent. The example sunny garden described here is a five-foot wide bed that wraps around three sides of a deck approximately six feet from the ground. Off to the edge of the deck bed is a small

island bed with a birdbath. The garden can be viewed and enjoyed from above and below. The species selected are generally the taller ones offering flowers at or above the deck edges.

Except for a few spring flowering clumps of columbine and sundrops, the deck bed is planted with summer and fall flowering species. The planting scheme is quite simple, going for a few masses of color and interest changing through the height of the growing season. First to be notable are several ample clumps of bee balm. Some prefer the blood red so often seen in the mountain coves, but there are so many color forms available that you can follow your preference. Imagine sitting on the deck and watching the hummingbirds essentially at eye level as they seek nectar from the flowers towering nearby.

Many of the species growing in sunny habitats are drought resistant and require only minimal, if any, watering. By growing these hardy plants (Section 4: Recommended Species) a continual color display can be maintained from late spring beyond the first fall frost, a period during which the woodland garden is not particularly colorful. Some perennials such as Queen Anne's Lace (*Daucus carota*), Goldenrods (*Solidago* species), and Asters (*Aster* species) are too often taken for granted. They are easily propagated, generally disease free, and add texture and color to a sunny garden area. By learning to recognize the seedlings and winter rosettes, plants that begin to proliferate can be transplanted or shared with others.

Much information has been published on growing perennials. Most native sun-loving plants are well suited to perennial beds. Instructions on site preparation of perennial beds can be found in the general gardening texts recommended in Section 7: Recommended Literature Guide. Very fine combinations of wildflowers and common horticultural varieties can be established such as Queen Anne's Lace planted with Daylilies (*Hemerocallis fulva* varieties). A challenging garden activity is the establishment of a roadside bed. Imagine a perennial bed with a background of native vines trained on scattered posts or a rail fence. Passion-Flower (*Passiflora* species), Trumpet Vine (*Campsis radicans*), Yellow Jessamine (*Gelsemium sempervirens*), Coral Honeysuckle (*Lonicera sempervirens*), and *Clematis* species provide a combined source of year round interest with color, fragrance, deciduous and evergreen foliage and dried fruit and seed. In front of this, establish common roadside species, including not only perennials but also annuals such as *Bidens* species

and biennials such as Woolly Mullein (*Verbascum thapsus*).

Patience is the key. Knowledge and pleasure will be gained by the frequent visits to various roadsides to study the variety of colorful plants, their blooming periods, and times of seed set. In time, you will enjoy in your own roadside beds many plants which often are never allowed to display their distinctive qualities due to highway mowing schedules which cut plants back before or at the peak of their flowering or due to shading and crowding from other plants.

Fertilization

Nutrient requirements of wildflowers are no different from those of agronomic or horticultural crops, but several things must be kept in mind in fertilizing wildflowers. Many grow in woods or other shaded sites where the upper part of the soil is rich in organic matter. Through the action of bacteria, fungi, and other soil microorganisms, the organic material is broken down into nutrients and other compounds available to the plants. Not only does the decaying organic matter provide a slowly available source of nutrients, it also furnishes a medium capable of holding water and a friable soil structure easily penetrated by plant roots. In many instances there is a close (and necessary) relationship between the wildflower and the soil microorganisms. Frequently soil fungi penetrate plant roots and aid in the uptake of materials from the soil.

While it is possible to supply mineral nutrients to wildflowers through chemical fertilizers, most growers prefer to add organic material to the soil as a source of nutrients. Such materials as decayed leaves, pine straw, decayed animal manure, cottonseed meal, peanut hulls, compost, grass cuttings, and peatmoss may be incorporated into the soil before planting or used as mulch around established plants. All of these materials are relatively poor sources of nutrients but, as they decay in the soil through the action of soil microorganisms, they provide a continuous supply of readily available inorganic nutrients.

Problems can develop, however, through the indiscriminate use of organic materials in soils. The decay process is caused by the action of bacteria and fungi, organisms that require nutrients, particularly nitrogen, for their growth. If the applied organic material has a low level of nitrogen, phosphorus, potassium, the decay organisms may induce a temporary reduction in the availability of

these elements to nearby plants. In such instances, the application of small amounts of a soluble, inorganic fertilizer frequently will alleviate the situation. The best way to avoid problems is to use only well rotted or composted materials. Also once plants have been transplanted from the wild and established a vigorous root system, the addition of small amounts of soluble, inorganic fertilizer may be beneficial.

Another problem to be considered in fertilizing wildflowers or any other plant, is the degree of acidity or alkalinity of the soil. The term pH refers to the acidity or alkalinity of any solution. A pH of 7.0 is neutral (boiled distilled water) while a pH less than 7 is acid and a pH more than 7 is alkaline. The pH scale runs between 0 and 14. A concentrated acid such as hydrochloric or sulfuric acid has a pH near 0 while concentrated solutions of sodium or potassium hydroxide (lye) have a pH near 14. Most agronomic soils have a pH between 6 and 7, slightly acid, and the majority of plants grow well under these conditions. If a soil test reveals that the pH is 5 or below, the addition of limestone is recommended to bring the pH up to between 6 and 7. If the soil is quite alkaline, as in limestone regions, the addition of small amounts of powdered sulfur can lower the pH to between 6 and 7.

While a soil pH of between 6 and 7 is satisfactory for most plants, some wildflowers require acid conditions (pH between 4.5 and 6) for optimal growth such as azaleas, rhododendrons and many broadleaf evergreens. Starting with a soil of pH 6 to 7, the addition of certain organic materials such as cottonseed meal, pine needles or oak leaves will lower the soil pH as these materials decay. Peat moss is the best organic material for providing an acid soil. The applications of powdered sulfur will accomplish the same result. To raise the pH of an acid soil, add ground limestone or lime, pulverized oyster shell, or calcium nitrate fertilizer.

Under ordinary conditions of nutrition and watering, many plants may tolerate a rather broad range of soil pH values (5.5 to 7.5). However, some species are quite sensitive to soil pH and must be handled on an individual basis. The conditions stated above for making soils acid or alkaline can be followed.

Transplanting

When collecting from natural areas that are to be disturbed by roadway, commercial or residential developments, care should be practiced to collect during the dormant season if possible. Prune plants vigorously and keep the entire plant in a moist and shaded situation during the moving process. The best time to collect plants is while they are dormant from November through February. Mark plants during the growing season to be collected during winter for best results. If construction schedules do not allow, plants should be dug after a good rain while there is plentiful moisture in the ground. Cloudy, rainy days are ideal for transplanting. If plants, particularly shrubs and trees, are not severely pruned, i.e., cut back at least to within one third of their original size, transplant success is doubtful. Moisture continues to move from the plant through its leaf surfaces and when that surface is not reduced to compensate for loss of most of the plant's root system there is simply more water moving out of the plant than moving into it and it subsequently dies from drought. When moving plants, dig them with soil, wrap the roots with aluminum foil or plastic, water and clamp the foil or plastic tightly around the roots. This procedure helps keep moisture around what is left of the root system during transport. Additional plastic wrapped around the entire plant will conserve the moisture within the plant until it is returned to the ground. Do not allow sun to strike the plastic during this process to avoid excessive heat killing the plant.

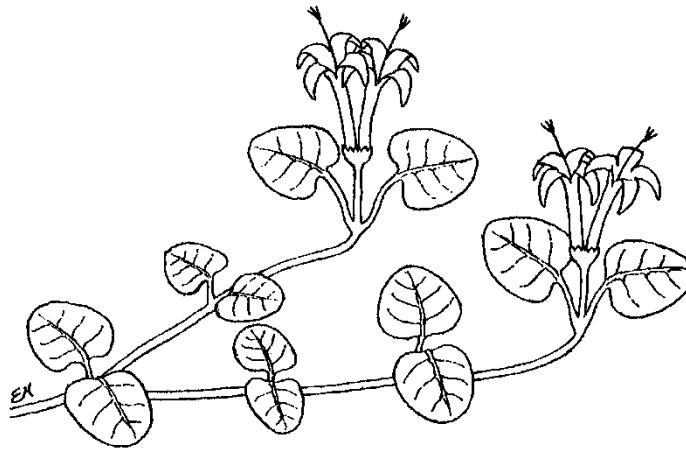
Trees: Collect only small specimens, usually less than a foot high; or in the case of very difficult species, such as Fraser's Fir (*Abies fraseri*), and Red Spruce (*Picea rubens*), only inches high for maximum chance of survival. Spruce, fir and pine do not branch well after pruning and should not be pruned when moved. It is thus necessary to transplant only small specimens of these species. Often because of fungi associated with the roots, not only of trees, but also of shrubs and herbaceous plants, a quantity of the native soil should be moved with the specimen.

Shrubs: Unless nursery grown, shrubs such as azaleas (*Rhododendron* species), laurels (*Kalmia* species), Wax Myrtle (*Myrica cerifera*), and Sweet Pepperbush (*Clethra alnifolia*), should be cut back from one-third to two-thirds before digging. Drastic

pruning is the most difficult task to accept, but plants respond remarkably well to severe pruning in late winter or early spring, and the resulting densely sprouting shrub for the next year is much more desirable than having the original full-sized shrub stand dead in its new location.

Herbaceous plants: If the plant is an annual or biennial it is best to collect seed and start them directly in your garden. If you lack experience in identifying the stocky root system, rhizomes, or bulbs distinguishing perennials from annual and biennials, many wildflower guides indicate what form each plant has. Small plastic bread wrappers and sheets of aluminum wrap are good for conserving moisture around the root systems. Be generous in collecting soil with the plant. When setting those herbaceous plants in their new location, mark each so as not to dig them up during future transplanting. This is a good time to divide robust clumps of perennials such as Foamflower (*Tiarella cordifolia* var. *collina*) and Christmas Fern (*Polystichum acrostichoides*).

These same considerations should be remembered even when transplanting material from the backyard nursery site, though the actions need not be as drastic. Generous watering should be maintained on all transplanted material until they are fully established, which may take several years for trees and shrubs.



Cultivation Requirements Chart

| | | Symbols | |
|------------|---|---------|---|
| Full Sun | ○ | Dry | D |
| Part Shade | ◐ | Moist | M |
| Full Shade | ◑ | Wet | W |

| | | | |
|--------------|----|--------------|----|
| Acorus | OW | Delphinium | ◐M |
| Amianthium | OM | Dicentra | ◐M |
| Amsonia | OD | Dionaea | OW |
| Anemone | ◐M | Disporum | ◐M |
| Aquilegia | ◐M | Dodecatheon | ◐M |
| Arisaema | ◐W | Drosera | OW |
| Asarum | ●M | Echinacea | OD |
| Asclepias | OD | Epigaea | ◐M |
| Baptisia | OD | Eupatorium | OM |
| Belamcanda | OM | Galax | ◐M |
| Cassia | OM | Gaura | OD |
| Chamaelirium | ◐M | Gentiana | ◐M |
| Chimaphila | ◐M | Geum | ◐M |
| Chelone | OW | Gillenia | ◐M |
| Chrysogonum | OD | Helonias | ◐W |
| Cichorium | OD | Hepatica | ◐M |
| Claytonia | ◐M | Heterotheca | OD |
| Clematis | OM | Hibiscus | OM |
| Clintonia | ●M | Houstonia | OM |
| Clitoria | ◐M | Hydrastis | ◐M |
| Collinsonia | OM | Hymenocallis | OW |
| Coreopsis | OD | Iris | OW |
| Corydalis | OM | Jeffersonia | ◐M |

Cultivation Requirements Chart

| | | Symbols | | | |
|-------------|----|--------------|----|-------|---|
| Full Sun | O | | | Dry | D |
| Part Shade | + | | | Moist | M |
| Full Shade | □ | | | Wet | W |
| Kosteleskya | OW | Pinguicula | OW | | |
| Liatris | OM | Polygala | ◐M | | |
| Lilium | OM | Polygonatum | OM | | |
| Lobelia | ◐W | Portulaca | OD | | |
| Lupinus | OD | Rudbeckia | OM | | |
| Lychnis | OM | Ruellia | ◐M | | |
| Malva | ◐M | Salvia | OM | | |
| Marrubium | ◐M | Sanguinaria | ◐M | | |
| Matelea | OM | Sedum | ◐D | | |
| Mazus | ◐M | Shortia | ◐M | | |
| Meehania | ◐M | Silphium | ◐M | | |
| Mimulus | OW | Solidago | OD | | |
| Mitchella | ◐M | Spigelia | ◐M | | |
| Monarda | ◐M | Swertia | ◐M | | |
| Nelumbo | OW | Thalictrum | ◐M | | |
| Opuntia | OD | Thermopsis | OD | | |
| Orontium | ◐W | Trillium | ◐M | | |
| Pachysandra | ◐M | Verbascum | OD | | |
| Panax | ◐M | Verbesina | OD | | |
| Passiflora | OM | Veronica | ◐M | | |
| Paxistima | ◐M | Zephyranthes | | | |
| Phacelia | ◐M | atamasco | ◐W | | |
| Phlox | ◐M | candida | ◐M | | |

Section 3: Propagation of Native Plants

Seed Propagation

The propagation of native plants is an activity that may present many problems. It can be discouraging when many efforts seem to result in failure, but it is interesting work and will afford much pleasure when success is achieved. The prime objective of nature is the preservation of the species. This is usually carried out through the production of seeds and their subsequent germination and growth. A reasonable amount of success is ordinarily expected with seeds purchased from a seed-supplier for planting in the flowerbed or garden. This is because these seeds were produced on plants bred and selected for easy germination in high percentages. These processes, when carried out in nature, are not nearly so exact. Pollination is mostly through the agency of wind and insects and is, at best, a matter of chance. Many non-viable seeds result.

Seed dispersal is another factor that is very much a matter of chance in nature; it may be done by wind, water, birds, animals, or man. The locations in which the seeds are deposited may or may not favor the germination and future growth of the plant. Survival rate is low in nature, and often thousands to millions of seeds are shed before a single successful plant develops. By collecting seed from healthy plants and planting it under more favorable conditions, better germination can be expected. Attention must be given to the nature of the seed, various soil conditions, temperature, light, and other factors.

A careful study of the situation in which plants are found growing in the wild including soil type, pH, moisture, and light can be helpful in their propagation in a different locality.

One of the most important items in working with native plants is complete and accurate record beginning with the collection of seed. Note the date, the nature of the habitat, soil and moisture conditions, and other plants growing nearby which may have similar requirements. Keep a record of which seeds are planted, as well as the soil mixture used. Record the germination date and make notes of everything with regard to the quality of the seedlings, including an estimate of the percentage of germination.

The same procedure should be followed with the rooting of cuttings. Record the date on which they were started, what rooting

hormones, if any were used, the date they were taken from the cutting bed, and the quality and quantity of roots formed. None of this data will be of much significance for the first year or two, but after that time you will have established a precedent for each process which will be of more and more value as the years pass. Notes should be kept for frequent reference before any move is made toward propagation. In this way past mistakes can be avoided, and new and better methods devised for each endeavor.

Seed Collection

Seeds should be collected as soon as they mature. An unnecessary delay may result in seeds being lost through dispersion when the enclosure in which they are formed opens to allow them to escape. Birds and insects may attack the ripening seeds, and either leave them in unfavorable locations or destroy them completely. However, care should be exercised to make sure the seeds have reached the proper stage of ripeness for germination.

The appearance of the envelope in which the seeds are formed can usually be taken as an indication of the state of ripeness. If this is a fruit or berry, there is usually a very definite change of color, with a possible softening of the fruit. If the enclosure is a dry capsule or pod, there will likely be a change from green to brown or black and possibly an opening at the top or the sides. In some cases the seeds are forcibly ejected as the capsule opens, so the ripening process must be carefully followed or the seeds will be lost. This loss may be avoided by tying a piece of nylon or similar netting over the capsule before it begins to ripen.

Seeds which should be stored dry, frequently have too high a moisture content to be stored safely at the time of collection. These are best placed in a paper bag and kept in a dry place at room temperature for a few days to allow them to lose some of the moisture. They may then be stored (see next section).

Experience has also shown that some seeds lose their vitality quickly if they are allowed to dry. This is particularly true of those that bloom early in the spring. Among these are Bloodroot, Shortia, and Twinleaf. Many such seeds have a rather soft ridge along one side, called an aril, and if this is allowed to become dry the germination may be delayed for a year or more after planting, or it

may not occur at all.

Seed Storage

The condition of seed when mature can usually be taken as an indicator of how they should be stored. Generally speaking they should be kept in very much the same condition until time for planting. In other words, if the seed matures dry, they are best kept by cleaning, drying thoroughly, and storing in a dry place at room temperature. Paper envelopes provide the simplest and most effective containers for dry seed. The containers should be marked with the name of the species, any special attention that should be given them and any other pertinent information such as location and date of collection.

Seeds that ripen within a pulpy or fleshy covering require a different procedure. Gently crush the fruit and soak in water until the covering softens enough to be removed. This may require several days. Generally 24 hour soaking followed by rubbing through a screen or rolling the seed (about 10-15 in a batch) between several layers of old newspaper will remove all pulp at once. Many seeds that are formed with such a fleshy covering require a period of additional after-ripening prior to germination. In many cases the fleshy covering inhibits or prevents the seed from germinating before the embryo has effectively matured.

In addition, many species require one or more varying periods of cold temperatures or alternating warm and cold periods to break seed dormancy. Very hard seed coats such as nuts often require alternating freezing and thawing to physically break, crack or otherwise deteriorate the hard seed covering. One procedure for seeds with hard coats such as Silver Bell is to clean the seed of any covering they may have, stratify them at room temperature for a period of from two to three months, then cold stratification at refrigerator temperature for a similar period. This may be timed so that the process is completed at the proper time for spring planting. Here, again, germination may take place the first season or it may be delayed for another year. Scarification is another procedure for seed with very hard coverings such as Kentucky Coffee Tree, Hazelnuts, Greenbrier. The seed coat should be rubbed on sandpaper on one side of the seed until the inner softer portion is slightly exposed. Holding them against

a grindstone with a pair of pliers can scarify large hard seeds. Clipping a hole in the seedcoat with a nail clipper can scarify smaller seeds. Scarification allows water intake and more rapid and uniform germination.

In milder climates the seed may be planted in the open as soon as the protective covering is removed. Where winters are severe there is danger that the seed will be heaved out of the soil by repeated freezing and thawing unless they are planted much deeper in the soil than would normally be done. In such locations it is best to place the cleaned seed in a plastic bag with three or four times the seed volume of damp peat moss or vermiculite and store at normal home refrigerator temperature (35-40⁰F) until spring, when they are planted in flats or in the open. Germination may still not take place until the following spring.

Some seeds have a long period of viability. Others have a very short life span. As a rule seeds deteriorate on a gradual basis but this process is speeded up by adverse storage conditions. If the temperature and humidity are excessively high or low, rapid deterioration occurs. As a consequence, a good practice is to store seeds in a cool, dry place, such as sealed jars in a refrigerator, and process and plant them within approximately one year after they are harvested. This will insure a high percentage of germination. Since there are many variations of external and internal conditioning required for germination of native plant seed, it is of vital importance that accurate records are kept concerning all successes and failures of efforts at seed propagation.

Seed Sowing

When the time comes for planting seed, first consideration should be given to the soil to be used in either flats or seed beds. A very frequent hazard to small seedlings is that of damping-off. A fungus that attacks the seedlings at the point where they emerge from the soil causes this disease. Unless steps are taken to combat this disease, a full tray of seedlings may be lost in an incredibly short period of time. One of the simplest ways to prevent this occurrence is by the use of a commercial fungicide preparation. This may be obtained as a liquid, which, when diluted according to directions, may be used on the soil before planting as well as later in case the

seedlings are threatened by the same disease. It can be used freely without damage to the foliage. Another method of preventing such diseases is by sterilizing the soil in the oven at 180° F for 45 minutes. A thin covering of milled or shredded sphagnum moss on the surface of the soil will also help, but this material should not be allowed to become dry because in doing so it tends to form a solidified layer which may impede the emergence of the seedlings.

There is one disadvantage to the use of milled sphagnum as a germinating medium, but this occurs only in the case of seeds which require a year or more for germination. A secondary growth of the moss or slime of water mold may develop which can smother the small seedlings when germination takes place. When it is known or suspected that germination may be delayed, the use of granulated peat moss on the seedbed will usually give satisfactory results. With this one exception, milled sphagnum is probably the best material for this use.

Another method for germinating seeds is to use fine soil prepared by sifting sand and peat through a screen and mixing these in about equal amounts. This prepared soil media may be used in containers or on open ground and will improve seed germination and subsequent seedling development. It is especially good for very small seeds. Care must be exercised to insure good drainage to prevent disease and provide oxygen to the seeds and seedlings.

The depth at which seed should be planted is usually indicated by the size of the seed. Comparatively large seed should be given a covering of the potting mixture. Very small seed are sown on the surface of the milled sphagnum moss without any covering, but unless there is an underlying layer of soil, the seedlings should be transplanted as soon as the first true leaves appear, since there are no nutrients in the sphagnum. In case it is not convenient to make this transplanting, the seedlings may be allowed to continue growth if they are fed a dilute solution of liquid plant food.

When planted as outlined above, the flat should be covered with glass or plastic in order to maintain high moisture content until germination takes place. The covering may then be removed and water added as needed to keep the soil and roots moist. A covered flat should be placed where direct sunrays cannot overheat it. Early transplanting is always a good practice since seedlings are apt to be crowded and should be given more space to allow normal development. An advantage to the use of milled sphagnum is that the

seedlings may be taken out for transplanting without great damage to tiny root systems.

There are a number of factors that enter into the selection of the best time to plant seed. The nature of the seed is only one of them. Available facilities for protection during the period of germination must be taken into account. This includes protection (such as wire screening) from wildlife. Even the matter of personal convenience must be considered since any neglect before the seedlings are well established can be fatal to the project. Planting in an outside seedbed as soon as seeds are ripe is a good general practice.

A greenhouse or cold frame will allow a wide range of latitude as to the selection of planting time. If such facilities are not available, planting may be limited to spring or early fall. The habit of growth of each species should be considered in selecting a time for planting.

Annuals are planted in the spring after the soil has begun to warm. These plants grow, blossom, and form seed during the summer months, then die. Biennials usually bloom in the second summer after the seed are planted. Their blooming season may extend over most of the summer, but there is a continuous production of seed beginning very soon after the first bloom appears. This allows some seed to germinate during the remainder of the growing season. These seedlings are the ones that will produce blooms the following summer. Those seeds that formed later in the season may have germination delayed until the following spring, which could produce blooming plants for the next year.

Perennials may be planted at almost any season of the year if the seedlings can be kept in a protected place until such time as they are ready to be set in the open. Most of them are rather slow in developing and need some protection for at least two years before setting out. If space in a greenhouse is available perennial seed may be planted in the fall or early winter. Germination should take place in a matter of weeks and the seedlings will have the rest of the winter and all of the following summer to develop enough to allow them to be set in the open in the second spring. Shrubs and trees follow very much the same growth pattern as perennials, and the same general rules should be followed in their planting and care.

Notes on Germination of Seed

Success has been obtained using the following seed sowing schedules. Keep your own records as you repeat these procedures or develop new ones of your own. Remember that failures are as important as successes and both should be reported to the N.C. Wild Flower Preservation Society for future publication.

Seeds that need cold. Sow in late autumn or even in early winter in open ground, beds, or unheated frames, germination to take place in spring. They may also be sown in early spring provided they have been stratified or received refrigerator treatment for several weeks. Do not put in freezer.

| | |
|--|--|
| <i>Aconitum uncinatum</i> , Monkshood | <i>Jeffersonia diphylla</i> , Twinleaf |
| <i>Actaea pachypoda</i> , Baneberry | <i>Juniperus</i> species, Juniper, Red Cedar |
| <i>Anemone caroliniana</i> , Windflower | <i>Lilium superbum</i> , Turk's-cap Lily |
| <i>Arenaria caroliniana</i> , Sandwort | <i>Magnolia</i> species, Sweet Bay, Bull Bay |
| <i>Arisaema dracontium</i> , Green Dragon | Umbrella Tree, Cucumber Tree |
| <i>Arisaema triphyllum</i> , Jack-in-the-Pulpit | <i>Malus coronaria</i> , Crab-apple |
| <i>Asimina triloba</i> , Pawpaw | <i>Mitchella repens</i> , Partridgeberry |
| <i>Calycanthus floridus</i> , Sweet Shrub | <i>Myrica pensylvanica</i> , Wax Myrtle |
| <i>Carphephorus bellidifolius</i> , Carphophorus | <i>Penstemon</i> species, Beardtongues |
| <i>Camassia</i> species, Wild Hyacinth | <i>Phlox</i> species (Perennial), Blue Phlox, Creeping Phlox, Moss Pink, etc |
| <i>Clematis</i> species, Virgin's Bower, Leather Flower | <i>Pinus</i> species, Pine |
| <i>Convallaria majalis</i> , Lily of the Valley | <i>Prunus</i> species, Plum, Cherry, Peach |
| <i>Dicentra canadensis</i> , Squirrel Corn | <i>Rhododendron</i> species, Rosebay, Great Laurel, Purple Laurel, Azalea |
| <i>Dicentra eximia</i> , Bleeding Heart | <i>Sanguinaria canadensis</i> , Bloodroot |
| <i>Dodecatheon</i> species, Shooting Star | <i>Trillium</i> species, Trillium, Yellow Trillium, Nodding Trillium, Wake Robin |
| <i>Epigaea repens</i> , Trailing Arbutus | <i>Thalictrum thalictroides</i> , Windflower, Rue Anemone |
| <i>Erythronium americanum</i> , Trout Lily | <i>Viburnum</i> species, Hobble-bush, Witherod |
| <i>Galax aphylla</i> , Galax | Haw, Arrowwood, Moosewood |
| <i>Gaultheria procumbens</i> , Wintergreen | |
| <i>Iris cristata</i> , Dwarf Iris | |
| <i>Iris hexagona</i> , Blue Flag | |
| <i>Iris prismatica</i> , Slender Blue Flag | |
| <i>Iris verna</i> , Dwarf Iris | |
| <i>Ilex</i> species, Holly, Yaupon, Black Alder | |

Seeds that should be sown in early spring while soil is cool early spring or late fall.

| | |
|--|---|
| <i>Aletris farinosa</i> , Colic-root | <i>Kalmia angustifolia</i> var. <i>caroliniana</i> , Sheep-kill/Laurel |
| <i>Allium cernuum</i> , Nodding Onion | <i>Kalmia latifolia</i> , Mountain Laurel |
| <i>Baptisia australis</i> , False Indigo | <i>Leiophyllum buxifolium</i> , Sand Myrtle |
| <i>Baptisia tinctoria</i> , Wild Indigo | <i>Lonicera sempervirens</i> , |
| <i>Cephalanthus occidentalis</i> , Button Bush | |

| | |
|--|--|
| <i>Claytonia virginica</i> , Spring-beauty | Coral Honeysuckle |
| <i>Comptonia peregrina</i> , Sweet Fern | <i>Lupinus perennis</i> , Lupine |
| <i>Corydalis sempervirens</i> , Pale Corydalis | <i>Lyonia mariana</i> , Stagger-bush |
| <i>Eupatorium rugosum</i> , White Snakeroot | <i>Mertensia virginica</i> , Bluebells |
| <i>Franklinia alatamaha</i> , Franklinia | <i>Passiflora incarnata</i> , Passion-Flower |
| <i>Gentiana andrewsii</i> | <i>Polemonium reptans</i> |
| <i>Geranium maculatum</i> , Wild Geranium | <i>Robinia hispida</i> , Bristly Locust |
| <i>Gillenia trifoliata</i> , Indian Physic | <i>Ruellia caroliniensis</i> |
| <i>Heterotheca mariana</i> , Golden Aster | <i>Ruellia strepens</i> |
| <i>Hypericum hypericoides</i> , St. Andrew's Cross | <i>Sedum</i> species, Sedum, Stonecrop |
| <i>Hypericum stans</i> , St. Peter's- wort | <i>Silene caroliniana</i> , Wild Pink |
| <i>Hypoxis hirsuta</i> , Yellow Star-Grass | <i>Silene virginica</i> , Fire Pink |
| <i>Ipomopsis rubra</i> , Standing Cypress | <i>Viola</i> species, violet |

Seeds that should be sown in spring or summer, up to September.

If sown in spring or summer, be sure seedbed is shaded.

| | |
|---|---|
| <i>Amsonia tabernaemontana</i> , Blue Star | <i>Hypericum buckleyi</i> , |
| <i>Aquilegia canadensis</i> , Columbine | Mt. St. John's Wort |
| <i>Asclepias incarnata</i> , Swamp Milkweed | <i>Hypericum densiflorum</i> |
| <i>Asclepias tuberosa</i> , Butterfly Weed | <i>Hypericum mitchellianum</i> |
| <i>Blephilia ciliata</i> | <i>Hypericum prolificum</i> |
| <i>Boltonia asteroides</i> | <i>Kosteletskya virginica</i> , |
| <i>Coreopsis auriculata</i> | Seashore Mallow |
| <i>Coreopsis tripteris</i> | <i>Lobelia cardinalis</i> , Cardinal Flower |
| <i>Coreopsis verticillata</i> | <i>Lobelia siphilitica</i> , Great Lobelia |
| <i>Dracocephalum purpureum</i> , Obedient Plant | <i>Monarda fistulosa</i> |
| <i>Epilobium angustifolium</i> , Fireweed | <i>Monarda punctata</i> , Horsemint |
| <i>Hibiscus militaris</i> , | <i>Rudbeckia</i> species, Black-eyed Susan, |
| Halberd-leaved Marsh Mallow | Cone Flower |
| <i>Houstonia caerulea</i> , Bluets | <i>Scutellaria integrifolia</i> , Skullcap |

Seeds that should be sown in late autumn or in earliest spring in outdoor seedbeds. If sown too late in spring, they may lie dormant until the following year.

| | |
|---|---|
| <i>Arenaria caroliniana</i> , Sandwort | <i>Hepatica americana</i> , Hepatica, |
| <i>Chimaphila maculata</i> , Pipsissewa | Liverwort Pink Root |
| Spotted Wintergreen | <i>Iris tridentata</i> |
| <i>Cimicifuga racemosa</i> , | <i>Lilium canadense</i> , Canada Lily |
| Black Cohosh Meadow Lily | <i>Rhexia virginica</i> , Meadow Beauty |
| <i>Gentiana crinita</i> , Fringed Gentian | <i>Spigelia marilandica</i> , Indian Pink |
| <i>Helonias bullata</i> , Swamp Pink | <i>Thermopsis villosa</i> , Bush Pea |

Seeds that should be sown in early spring while the soils are cool.

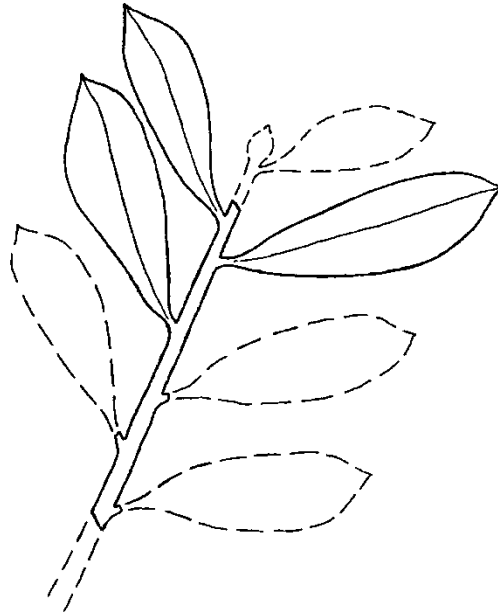
Aster novae-angliae, New England Aster
Euphorbia corollata, Flowering Spurge

Vegetative Propagation

Although the propagation of plants from seed is the method generally followed in the natural process, it may be a rather slow one. Several years may be necessary for plants to reach their blooming stage. This time may be greatly shortened by means of rooted cuttings or by division. Another advantage to either of these methods is that the resulting plant will be an exact duplicate of the parent plant. This is not always the case in propagation by seed.

Stem Cuttings

In most cases deciduous plants, those which lose their leaves in winter are best propagated by soft wood cuttings, using the new growth which is produced in early summer. A length of four to six inches is usually most convenient. The upper section of the cutting should be removed; this will include the terminal bud or tip. This tends to make the rooted cutting produce side shoots rather than grow into a single stem. There may also be a latent flower bud already formed at the tip which, if allowed to open, might require more energy than a freshly rooted cutting could supply without having its future growth impaired.



Leaves should be carefully removed from the bottom half of the stem and the stem itself cut with a sharp knife at a slant just below and opposite the lowest remaining leaf bud. In some species the roots will form only in the exposed cambium layer just below a leaf bud. In others, roots will form along the stem between nodes. It seems to be a safe rule to make the cut just below a leaf bud, as this will satisfy both conditions. Rooting is aided by shallowly removing a small piece of bark about half an inch in length on each side of the slanted cut.

Cuttings from some plants will take root readily without further treatment, while in others, the rooting process will be speeded up, or the quantity of roots formed may be improved, by the use of hormones. These are available in the form of a powder that is applied to the bottom quarter-inch of the cutting. Dipping the slightly moistened stem into the powder and shake off the excess before placing in a moist rooting bed. Rooting hormones are also available as liquids, which may be easier to use in some situations. The proper use of rooting hormones is largely a matter of experience.

The cutting thus prepared is placed in the rooting medium that is in a small housing of wooden framing covered with clear plastic, so that the cuttings are free to grow, but high humidity is maintained. A preferred place for this is a semi-shaded area. Direct sun on the propagation chamber is certain death for the cuttings. Plastic sweater boxes, plastic plant trays with polyethylene top covers, or simple terraria may all be utilized as propagation chambers just as effectively as the more sophisticated intermittent mist systems of professional greenhouses.

The choice of material in which the cuttings are placed for rooting is chiefly a question of what is most readily available. It may be sand, peat moss, vermiculite, perlite, or a combination of two or more of these materials. The requirements are that the medium retains moisture and that it allows aeration while the cutting roots.

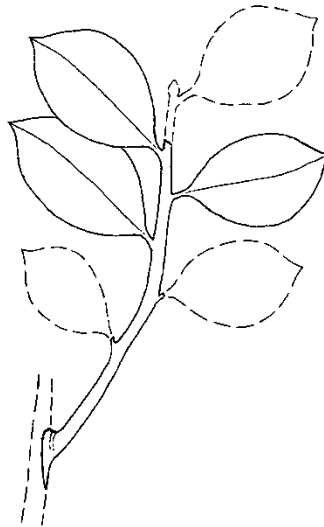
When roots have formed and have reached a length of about one-quarter to one-half inch, the cuttings may be transplanted to a suitable pot using soil like that prepared for seed flats. Most transplants respond favorably to the application of diluted liquid fertilizer. A good mixture for potting soil usually consists of equal parts of good garden soil, peat moss, and sand. These proportions may be altered to fit the individual requirements of certain plants. In most cases this will mean increasing the percentage of peat moss. Some garden stores sell a product called "top soil". This material has little

in the way of plant nutrients; if it is used in place of the garden loam it may be necessary to add plant food. Well-rotted cow manure is a good organic source of nutrients.

A great many herbaceous perennials may be propagated by softwood cuttings. These are taken in early summer after the stem growth has begun to harden. Rooting should take place in a matter of weeks, and the new plants should be ready for planting in the open the next spring. Most of these cuttings will take root readily without the use of hormones.

Evergreen plants may be increased in a similar manner, but the timing is different. They usually do well when cuttings are taken from late summer to early winter. This is a fortunate circumstance, because cutting beds normally have little in them at this time of year; cuttings taken at this season will have taken root and be ready for transplanting before time for soft wood cuttings to be taken in early summer. Good results are also obtained with late winter cuttings before spring growth commences.

The broad-leaved evergreens respond best if taken in late summer after the current season's growth has begun to harden. From mid-July until mid-August is the best time. The conifers, however, seem to give better response if cuttings are not taken until one or two frosts have hardened the new growth. Cuttings may be taken in mid-winter, but the rooting process would probably be delayed until late in the spring.



The cuttings of most conifers and some of the broad-leaved evergreens, such as hollies, take root more readily when the side growth of the current year is stripped from a larger twig, leaving a 'heel' at the base of the cutting. The foot may be shortened to a convenient length as long as some of the older bark and related cambium are left intact. In most of the evergreen species it is necessary to use a rooting hormone to insure satisfactory results.

Root Cuttings

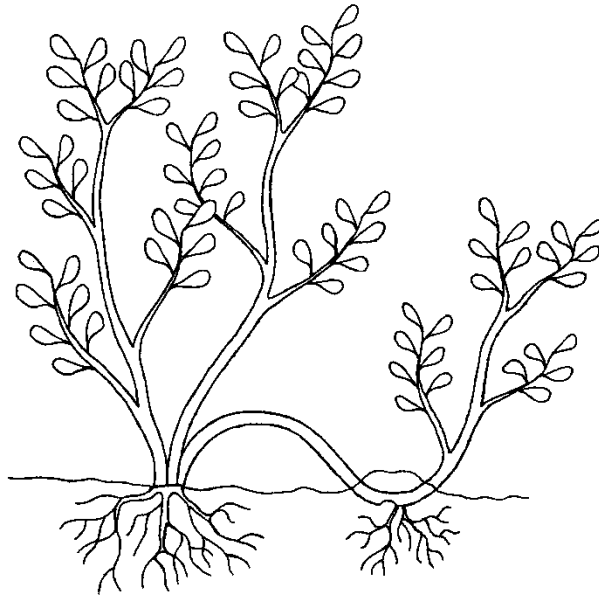
Stoloniferous plants, which have running roots, can be multiplied by means of root cuttings taken in early spring before the new top growth starts. Sections of root about one-quarter of an inch in diameter and an inch or longer are taken, making sure there is a latent bud near the top of the cutting. When placed upright in the cutting beds new roots should develop at the lower end, while the latent bud near the top will give rise to a new shoot. Treat the same as a stem cutting when new roots have formed. If top growth takes place without root formation, these slips may be removed when they are two or three inches long and returned to the cutting bed as if they were any other softwood cuttings.

Shoots, Divisions and Layering

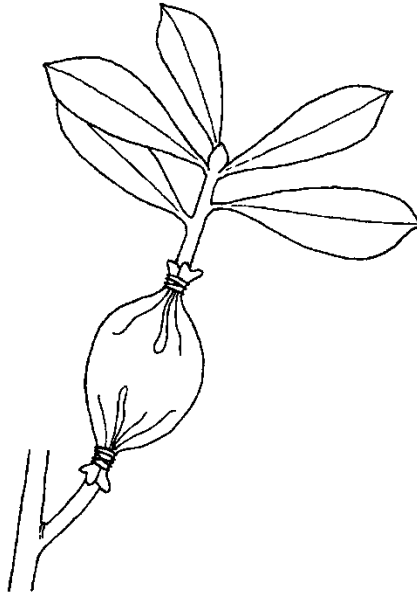
Some plants produce lateral root shoots. Examples of these are Persimmon, Hawthorn, Poplar, and Inkberry Holly. These may be dug, taking a short portion of the root from which they develop, and then planted. Suckers produced as shoots developing at the base of any plant just below ground level are good material for rooting. These may be removed with a 'heel' (sometimes a root may be present), cut back and placed in a container or propagation bed, covered with plastic and kept moist. The use of a hormone in the wound is effective.

Division is a method of increasing herbaceous perennials as well as some shrubs. The entire plant is dug from the ground after it has bloomed and is cut into smaller pieces, each of which will form a new plant. This is usually done in late summer or early fall. In the case of plants that bloom late in the season, division may be done in

early spring. There is always the chance that the new plants will not have recovered sufficiently to produce bloom during that season. Care must be taken that each division segment of the stock plant has both vigorous root and stem or shoot segments.



Layering is one of the simplest methods of propagating hard-to-root plants and any other plant having stems or runners sufficiently long to manipulate. Vines and established plants may be rooted or ground-layered by removing a piece of bark from the stem and bending the stem to the ground. The stem is fixed below the soil level and weighted down with a rock or other heavy object. Treating the wound with a rooting hormone and adding peat or decayed humus to the soil heaped around the wounded portion will aid the rooting process. Often alternate burying and exposing parts of a branch and cutting off the newly rooted sections can produce several new plants. Some plants will strike roots in one season while others may require two or more years. It is best to sever the branch from the clone one or more seasons before moving the plants.



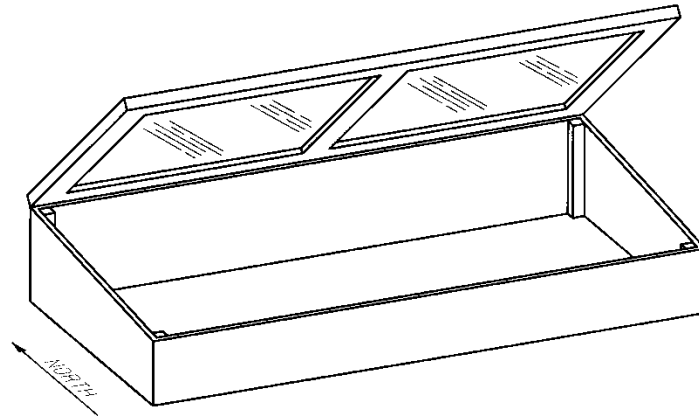
Air layering can also be used effectively by removing a 1/4 to 1 inch wide band of bark at least 3/4 the way around the stem about 6-10 inches from the tip of the stem. A sizeable ball of sphagnum (moistened) is placed around the stem at the point of the wound, wrapped with plastic and tied in place above and below the sphagnum. If the air layer is in the sun, aluminum foil should be used to cover the plastic or sunlight will cause excess heat in the sealed area that must be kept moist. When roots are visible through the plastic, the stem is cut just below the plastic and planted in soil after carefully removing the plastic.

Simple Cold Frame Propagation

Many gardeners find cold-frames very useful for their propagation activities. Cold-frames are easily constructed (standard size is 3 ft. x 6 ft.) by building a wood frame or concrete block structure on a site protected from winds and oriented so that the sash covering of glass, or plastic can slope from the back to the front (north to south). In areas where winters are severe the structure is sunk in the ground as much as 18 inches. During normal winters in central and eastern North Carolina, the cold-frame is usually adequate

merely sitting on the ground surface. A sunken frame is recommended for mountain areas. Care must be taken to provide shading with slats or netting during summer months to avoid excessive heat build up.

Adequate ventilation and watering must be provided depending upon existing weather conditions and stage of plant development. For tender young plants and cuttings the sash is generally kept closed for high humidity, and as plants mature or cuttings root the sashes are opened for ventilation and drier conditions. Any desired growing or rooting medium may be placed in bottom of frame or the frame may be merely used to cover winter plants in containers.



Below is a list of native plants that have been successfully propagated in the Piedmont area in a cold-frame by cuttings taken over a period beginning July 1 and ending August 8. Sand was the rooting medium and the beds were enclosed with boards 10 to 12 ins. high, covered with wire of 1 and 2 in. mesh and followed by a tight covering of 4 mil. polyethylene film. Half shade overhead was provided with available boards and strips. Except for occasionally removing the polyethylene film in the middle of the day for short periods to prevent damping-off, the beds remained covered until after the danger of frost the following spring. Care was taken at all times, before and after removal, to see that the sand remained moist. Only new-wood cuttings, 3 to 4 ins. long (except *Paxistima*, which were

short), were used. Two pairs of terminal leaves were left on each cutting.

Plants that can be propagated by placing cuttings in a cold-frame

| | |
|--|--|
| <i>Amsonia tabernaemontana</i> forma <i>alba</i> , White Dogbane | <i>Kalmia cuneata</i> , White Wicky |
| <i>Amsonia ciliata</i> , Blue-Star | <i>Litsea aestivalis</i> , Pond Spice |
| <i>Bumelia lycioides</i> | <i>Monarda fistulosa</i> , forma <i>alba</i> , White Beebalm |
| <i>Bumelia tenax</i> , Evergreen Buckthorn, Buckthorn Mountain Lover | <i>Oxydendrum arboreum</i> , Sourwood |
| <i>Ceratiola ericoides</i> , Wild Rosemary | <i>Paxistima canbyi</i> , Cliff-Green, |
| <i>Cornus florida</i> , Flowering Dogwood | <i>Philadelphus inodorus</i> , Mock-Orange |
| <i>Diervilla sessilifolia</i> , Bush Honeysuckle | <i>Rhamnus caroliniana</i> , Buckthorn |
| <i>Euonymus obovatus</i> , Running Strawberry Bush, | <i>Rhododendron arborescens</i> , Smooth Azalea |
| <i>Fothergilla major</i> , Witch Alder | <i>Rhododendron calendulaceum</i> , Flame Azalea |
| <i>Franklinia alata</i> , Franklinia | <i>Rhododendron catawbiense</i> , Mountain Rose-Bay, Purple Laurel |
| <i>Gelsemium sempervirens</i> , Yellow Jessamine | <i>Rhododendron minus</i> , Carolina Rhododendron |
| <i>Hamamelis virginiana</i> , Witch Hazel | <i>Rhododendron nudiflorum</i> , Pinxter-Flower |
| <i>Hypericum buckleyi</i> , Mtn. St. John's Wort | <i>Rhododendron vaseyi</i> , Pink-Shell Azalea |
| <i>Hypericum graveolens</i> , Mtn. St. John's Wort | <i>Rhododendron viscosum</i> , Swamp Azalea |
| <i>Ilex ambigua</i> var. <i>montana</i> , Mtn. Winterberry | <i>Rhododendron viscosum</i> var. <i>serrulatum</i> , Fragrant Azalea |
| <i>Ilex cassine</i> , Dahoon Holly | <i>Ribes</i> species. The Gooseberries |
| <i>Ilex cassine</i> var. <i>myrtifolia</i> , Myrtle Leaf Holly | <i>Satureja georgiana</i> , Wild Basil |
| <i>Ilex decidua</i> var. <i>longipes</i> , Large Fruited Deciduous Holly | <i>Stewartia ovata</i> , Mountain Camellia |
| <i>Ilex opaca</i> , American Holly | <i>Styrax americana</i> , Storax |
| <i>Ilex verticillata</i> , Winterberry | <i>Zenobia pulverulenta</i> , Honey-cup |
| <i>Ilex vomitoria</i> , forma <i>nana</i> , Dwarf Yaupon | |
| <i>Kalmia angustifolia</i> var. <i>caroliniana</i> , Sheep-kill, Sheep Laurel | |

Fern Propagation

Fertile fronds are removed from robust plants when fruit dots (spores) on the lower leaf surface are dark brown (usually in July or August). On fertile fronds, the underside of the frond has dots not unlike the appearance of scale insects. Spores are collected by gathering fronds when fruit dots begin to turn brown, laying them on a sheet of white paper placed in a dry atmosphere where there are no air currents. Spores will fall out as the fronds dry. The spores will be evident in a few days.

The medium on which they are sown is a 3-2-1 mixture of sterile Michigan peat, vermiculite and sand finely sifted through 1/4-inch mesh screen. The medium is placed in flats two or three inches deep. There should be a one-inch space between the surface of the medium and the top of the flat. The surface of the medium is lightly tamped. Before sowing spores, the flat is placed in a tray or tub of sterile water, the depth of which is one half inch below the surface of the medium. The flat is left to soak until water has moved up to the surface of the medium then removed and allowed to drain. At this point the spores are scattered over the medium by bending the piece of paper (onto which the spores were scraped) into a U-shape (not a V-shape). The paper is held four to six inches above the flat and gently tapped while moving it over the surface of the medium. In this manner the spores are distributed fairly evenly over the medium. This should be done in an area where no wind currents occur.

After sowing spores, a glass pane or plastic wrap is placed over the flat to insure that a moist medium and humid air constantly surround the spores. The flat should be soaked in the above-mentioned way (*do not* water from above) twice per week at least until the first true leaves appear. The flats are never allowed to sit in water for long periods; they must be drained after each soak. Soaking twice per week causes very gentle flooding which is needed for growth of the young plants. Glasses should be turned with each soak. Optimum temperatures for germination of spores range from 65 to 75° F; flats *must* be kept from direct sunlight.

When the young ferns are one-half to one inch in height, they are delicately transplanted into another clean flat with the same medium, one and one half to two inches apart. There should be enough space between the surface of the medium and the top of the

flat to allow for further growth in height. Glass is again placed over the flat. Soaking is continued in the same manner, with a gradual transition to watering from above using a gentle sterile spray as the plants begin to resume growth.

When the ferns begin to grow into one another they are transplanted into two inch pots (peat or plastic). At this point they are fertilized with soluble 20-20-20 fertilizer at two to three week intervals to accelerate growth. One tablespoon per gallon of water is sufficient. When plants are two to three years old (depending upon species and environmental influences on the new plant) the ferns are planted outdoors in areas closely resembling their natural habitats. Clean sterile soil free of contaminants, sterile water, sufficient light and no overheating are key to fern propagation.

Another propagation method is by inverting a small, porous sterilized clay pot filled with uncut sphagnum or peat moss in a shallow tray of water and sprinkling spores from a single species over the bottom and sides of the inverted pot. The clay pot is then covered with a large jar or other structure to maintain high humidity and set where direct sunlight will not overheat it. Time of germination varies greatly for individual species. If this method is used it may be very difficult to remove the young ferns that appear on the clay pot.

For those that are reluctant to try growing ferns from spores because it looks too involved, we offer this simple method. Pour a few tablespoons of some soil (any type), into a glass jar. Pour boiling water into the jar. When the water cools drain off the water. Tap a few spores into the soil inside the jar and cover the jar opening with clear plastic wrap. Place the jar in a North window or fluorescent lamps for about 12 hours a day. You may see just as much success on your first try as with a more involved method. Give it a try!

Propagation of Specific Wild Flowers

Acorus calamus, Sweet Flag - This is a bog plant that must be grown in a situation where there is moisture at all times. It can be propagated by division or by root cuttings.

Adlumia fungosa, Climbing Fumitory - This is a biennial. It blooms in late spring and seed should be planted immediately. Seedlings will emerge later in the season, stay green through the winter, bloom, and then die. Unless the seeds are planted as soon as they are ripe the blooming will be delayed for another year.

Amianthium muscaetoxicum, Fly-Poison - The seed of this plant may be planted as soon as they are ripe or stored at room temperature and planted in the spring.

Amsonia tabernaemontana, Blue Star or Dog Bane - The seeds of this plant are formed in a narrow bean-like pod, and when taken out they resemble dried pieces of twig. Planted in the spring, they are easily germinated. Cuttings may be made from firm but not hard stems taken in spring and grown in half-shade under glass in sand.

Anemone species - The Windflowers are propagated by seed, planted at almost any season of the year.

Aquilegia canadensis, Columbine - This species spreads rapidly from seed with no help. Plants may be started in new locations by simply scattering seed where the plants are wanted. Columbine makes a good winter ground cover.

Arisaema triphyllum, Jack-in-the-Pulpit, and Green Dragon (*A. dracontium*) - These plants form bright reddish-orange berries early in the fall. Seed should be extracted from the berries, cleaned and stratified for spring planting.

Asarum canadense, Wild Ginger - This is a herbaceous perennial which, like its evergreen relatives, the *Hexastylis* species, spreads by means of rhizomes. Propagation is best done from mallet-type cuttings taken in early summer. These cuttings take root readily and

should produce blooming plants in two to three years. Sow seeds as soon as mature in good compost. *Asarum* is a good deciduous ground cover.

Asclepias species - The Milkweeds are plants that require full sun for their development. Seed should be planted in pots as soon as ripe, carried through the winter in a cold frame, then transplanted in the open in early spring. Butterfly Weed (*Asclepias tuberosa*) is sometimes found in bright yellow, instead of the usual orange. The seed may not produce flowers of this same color, so the best way this one may be propagated is by root cuttings taken in early spring before the top growth starts.

Baptisia species - The Baptisias are found in various colors, creamy-yellow, white, or blue. All form seed in a dry pod. Seed may be planted in the fall or kept dry at room temperature for spring planting. Soak overnight in hot water before planting.

Cassia marilandica, Wild Senna - This is another member of the Pea Family, all of which respond to similar treatment. Seed planted in the spring will germinate better if placed in boiling water and left to set and cool in the water overnight.

Chamaelirium luteum, Devil's Bit - This species is dioecious, one plant has staminate (male) flowers only and pistillate (female) flowers are found on separate plants. Both sexes are necessary for seed production. Store seed at room temperature over winter and plant in spring.

Chimaphila maculata, Pipsissewa or Spotted Wintergreen - These plants have very small seeds that germinate in moist leaf mold and develop into blooming plants usually in the second year. It is very difficult to transplant from the wild.

Chelone species - Turtlehead seed may be planted in the spring in a protected place or cold frame for transplanting the second year. They may then be planted in the open in moist ground if the location is such that the seedlings will not be disturbed before they reach blooming size.

Chrysogonum virginianum, Green-and-Gold - This species makes a good ground cover, which will spread by stolons when plants become established. Most members of the Sunflower family are very generous with seed, but those of this plant are difficult to obtain. Propagation is chiefly by division of cuttings.

Cichorium intybus, Chicory - This plant is propagated by seed sown in spring or fall and by root cuttings taken in early summer.

Clematis species - All species of *Clematis* can be grown from seed, but germination is erratic and uncertain in some species. Seed may be planted either in fall or in early spring. Some species can be propagated readily from stem cuttings. In a favorable situation, *Clematis virginiana* can become a pest.

Clintonia species - Bead Lilies form seed enclosed in a fleshy blue or black covering, which should be cleaned, stratified, and planted in the spring.

Clitoria mariana, Butterfly Pea - Store seed of this species over winter at room temperature and plant them in early spring.

Collinsonia species - Known as Richweeds or Horsebalms these plants are propagated by seeds sown either when ripe in summer, or planted in early spring.

Coreopsis species - *Coreopsis* is a hardy perennial that is easily grown from seed planted at almost any time of the year. Mature plants may be increased by division.

Corydalis sempervirens, *Corydalis* - This plant is a biennial, flowering during the second year. Propagate by sowing seed as soon as ripe, for bloom the following year. In a favorable location it may become troublesome.

Delphinium species - Larkspurs seeds are formed dry in a pod that calls for close observation in order to collect seeds before they are dispersed. Keep seeds at room temperature and plant in the spring. Outside the Mountains, plant in a cool shaded spot with a very light mulch.

Dicentra eximia, Bleeding Heart - Sow seed where the plants are to be grown as soon as they are ripe. This perennial prefers a slightly moist and shady location.

Dionaea muscipula, Venus' Flytrap - Sow mature seed immediately on long fiber sphagnum, keep moist and in filtered sunlight. They should germinate in 30-40 days. Division of the bulb-like rhizome is also effective. Separate the rhizome at natural divisions and pinch back the traps and leaf petioles to compensate for root loss. Plant in sphagnum or fine sandy soil in a wet bog.

Disporum lanuginosum and *D. maculatum*, the Mandarins - These plants form seed enclosed in a fleshy covering. Clean, stratify by refrigeration for 2 months, and plant in spring.

Dodecatheon meadia, Shooting Star - These may be planted in fall as soon as the seed is ripe.

Drosera species - The Sundews, *D. capillaris*, seeds are collected as soon as ripe and sprinkled on flats of long fiber sphagnum kept moist and in filtered sunlight. High percentage of germination occurs within a month. It is important to keep the seeds damp, but do not allow strong overhead watering to wash the small seeds together in a low spot making separation of seedlings very difficult. *D. filiformis* is propagated vegetatively by cutting young leaves into small segments and placing on long fiber sphagnum in a flat covered with glass or plastic and kept out of direct sunlight. Make certain sphagnum stays moist. *D. rotundifolia* is treated in similar manner using the entire young leaf on the sphagnum. Within 45 days both species produce vegetative buds, and small plants with roots form within 90 days.

Echinacea species - The Purple Coneflowers are easily grown from seed planted either as they ripen or in spring.

Epigaea repens, Trailing Arbutus - These plants may present the greatest challenge in obtaining the seed. The capsules open in approximately mid-June in N.C. Piedmont. Daily visits to the plants as the capsules begin to turn brown may be necessary if one is to be successful. Alternatively the small capsules can be enclosed in a paper

or fine mesh bag to catch the seed. Sow seeds immediately on mixture of equal parts well-rotted sawdust and sharp sand. Settle seeds into top of mix gently with misting and cover with glass in partial shade. Make certain medium is not allowed to dry. Germination should occur within six weeks. Several leaves should be on each plant by November. Protect plants through winter in cold frame and transplant the larger plants to separate pots just before spring growing season. Plants should be large enough to set out in a permanent site after the second winter. Stem cuttings can be rooted if taken in early summer and kept under high humidity. Though usually found in dry locations, this plant should be watered frequently after being set out, until well established.

Eupatorium maculatum, (and *E. purpureum*), Joe-Pye-Weeds - These plants are grown from seed collected before they are scattered by the wind, then sown in moist soil in the open or cold frames.

Galax aphylla, Galax - Seed is collected in mid or late summer. They should be planted in the open as soon as they are ripe. Galax is a good evergreen ground cover.

Gaura angustifolia and *G. biennis* - The Butterfly Flowers are interesting members of the Evening Primrose family and are grown from seed planted in the spring.

Gentiana species - Perennial Gentians are plants that form seed in late fall or early winter. The seed should be stored dry at home refrigerator temperature for about two months. They are then planted in flats filled with moist soil with a covering of milled sphagnum moss. The flat is then enclosed in a plastic bag and placed where it will be subject to freezing and thawing with the natural variations of the weather. Germination should occur in early spring.

Geum radiatum, Mountain Avens - This plant grows at high elevations. The seed from this plant seems to benefit by a week or ten days stratification at zero degrees. This is a very rare species and natural populations should not be disturbed.

Gillenia species. Indian Physic seed may be planted in early spring should produce blooming size plants in two to three years.

Helonias bullata, Swamp Pink - This is a bog plant that produces seeds in abundance, but both germination and seedling growth are very slow. If planted in a favorable moist location offsets are produced, which may be grown into separate plants by division. Store seed at room temperature during winter and sow in the spring.

Hepatica species - Liver Leafs are best propagated by division of mature plants. They spread naturally in a favorable location, but seeds are difficult to find.

Heterotheca graminifolia and *H. mariana*, Golden Asters - These have seed that ripen in late fall. They may be planted as soon as ripe or saved for spring planting.

Hibiscus species - The Mallow family plants are easily grown from seed planted in the spring.

Houstonia species - The Bluets seed should be sown as soon as ripe on the surface of moist milled sphagnum with no covering.

Hydrastis canadensis, Golden Seal - This plant has bright red fruit from which seed should be cleaned and planted immediately when ripe. Germination may not occur until the second spring.

Hymenocallis crassifolia, Spider Lily - This plant multiplies quickly by multiple bulb formation. Young bulbs produce a flowering plant the second year after division.

Ipomopsis rubra, Standing Cypress - Seed of this species may be planted at any time of the year. Plants should reach blooming size by the second year.

Iris species - Our native Iris can be grown from seed sown in a cold-frame covered with burlap. Propagation is best by division of clumps.

Jeffersonia diphylla, Twinleaf - This is an early blooming plant whose seed must be planted as soon as it is ripe. If the seeds are allowed to become dry, germination may fall to near zero.

Kosteletskya virginica, Seashore Mallow - May be grown from seed planted in the spring. Seedlings should be transplanted to a wetland or bog after the first year.

Liatris species - Blazing Star or Gay Feathers seeds should be planted outdoors in potting soil after they ripen in September or October. They usually germinate in early spring the following year.

Lilium species - The Lilies produce a *great* number of seeds, but these need special treatment for satisfactory germination. Gather the seeds as soon as they are ripe, seal in plastic bags in damp peat moss and keep at room temperature. Germination should begin in six to eight weeks. Package should then be placed in refrigerator until early spring, when the small bulbs that have formed may be planted in the open. A speedier method is the use of bulb scales. Dig the mature bulb after the flowers have faded, remove some of the outer scales from the bulbs and treat them the same as seeds. When the small bulbs have formed they may be planted in the open, deep enough to prevent heaving during the frost. Flowers will not be produced for several years.

Lobelia species - The Cardinal Flower, *L. cardinalis*, is an outstanding member of this group. It grows best where there is plenty of moisture, even standing in shallow water. The other species can be grown in drier locations. All can be grown from seeds planted in either fall or spring. Germination percentage is increased when seeds are stored dry in refrigerator over winter.

Lupinus perennis, Lupine - This plant has been successfully propagated by placing moist seed in closed plastic bags in a dark warm place. When sprouted, they are planted in peat pots and fed lightly to strengthen them for planting outdoors. Another successful method is to soak seed overnight in hot water before planting.

Lychnis species - White Campion, *L. alba*, naturalized from Europe, is a night bloomer. A more striking one is the Mullein Pink, *L. coronaria*, which blooms in the daytime. Both are easily grown from seed stored at room temperature and planted in spring or by division.

Lycopodium species - The Clubmosses (*L. obscurum*, *L. tristachyum*

and *L. complanatum*) can be transplanted by tracing the stem to the location to a deeply rooted node that is more substantial than the superficial stem roots. Transplant this rooted section.

Lythrum species - Loosestrife seeds should be gathered when mature and sown in flats or in cold-frames. These do well if the soil is kept moist and partially shaded, as under a slat house. Plant in a moist spot. The Purple Loosestrife is a very aggressive and invasive plant that should not be propagated and planted in the US. Other non-native Loosestrife species are also aggressive and invasive and should not be considered as garden introductions.

Malva species - Seeds of the Mallows should be planted in early spring.

Marrubium vulgare, Horehound - This plant is a naturalized import from Europe. It can be propagated by seed planted in the spring and given protection until the following spring, when the seedlings can be planted in the open. It can also be propagated by layering.

Matelea species - The Climbing Milkweeds seeds may be planted at any season.

Meehania cordata, Creeping Mint - This species is propagated by stem cuttings taken in early summer.

Mimulus species - Monkey Flower has tiny seeds that should be stored over winter at room temperature and planted either in flats or in the open in early spring.

Mitchella repens, Partridgeberry - Can be propagated by seed which has been cleaned and stratified (cold treated) in the refrigerator over winter for spring planting. A faster method is by stem cuttings taken in early to mid summer. They take root readily in only a few weeks.

Monarda species - Beebalm or Bergamot can be propagated by seed, but it is easier to use division by stolons planted in fertile soil. Horsemint, *M. punctata*, is easily grown from seed sown indoors at the end of fall when seed can be collected.

Nelumbo lutea, Yellow Lotus - This aquatic plant grows around the edges of ponds. Due to its deep root system it is very difficult to transplant. Scarified seed germinate in wet muck.

Opuntia compressa, Prickly Pear - Seeds of this cactus that are cleaned germinate readily, but may require three to four years to produce a blooming plant. Cuttings of the fleshy leaf-like stems root easily when taken in August or early September. Alternately an entire stem can be rooted in sandy well-drained soil.

Orontium aquaticum, Golden Club - This wetland plant produces large gummy seeds that should be collected in mid summer, cleaned and sown immediately in wet or mucky soil where plants are desired in the garden. An alternate method is to sow in gallon containers with the drainage holes punched in the sides about one inch from top. Fill can with good soil mixed with sand, keep moist and plants should be ready to set out in permanent wet site after a year.

Pachysandra procumbens, Allegheny Spurge - Seed collection of this species is difficult. It can be easily propagated by division or stem cuttings taken in early summer and kept shaded and moist. If a greenhouse is available these cuttings may be taken in mid winter.

Panax quinquefolium, Ginseng - This species seed should be sown as soon as ripe in nutrient rich soil in shade. They will germinate and grow readily.

Parnassia species - There are several species of Grass-of-Parnassus, but all respond to similar treatment. They bloom in late summer or early fall, so seeds may not ripen until after cold weather begins. Seeds are very small, should be stored dry over winter, and planted in spring. The seedlings should be placed in a moist location the following spring.

Passiflora incarnata, Passion Flower or Maypop - This plants seed should be removed from the fruit and cleaned as soon as they are ripe. They may be planted immediately or stratified for spring planting. They should not be allowed to become dry at any time. Softwood cuttings taken in summer root easily.

Phacelia species - Phacelias are annual or biennial plants that are easily started from seeds planted in the fall.

Phlox species - Known as Phlox or Pinks, most of the species of this group are best propagated by division. The stoloniferous species, however, respond to stem cuttings taken at any time after growth starts in the spring.

Pinguicula species - Seeds of Butterworts are sown as soon as mature on damp long fiber sphagnum, kept moist in partial sunlight for germination in approximately 90 days.

Polygala paucifolia, Gaywings - These plants are easily propagated by stem cuttings taken after the bloom has faded.

Polygonatum biflorum, Solomon's Seal - This species may be propagated by seed stratified over winter and planted in the spring.

Portulaca pilosa, Purslane - This plant has naturalized throughout the coastal plain. It grows well from seed, which germinate in about ten days at warm temperatures. Cuttings of the succulent stems root readily.

Rudbeckia species - Black-eyed Susan and related species, may be propagated by seed planted at any time.

Ruellia species - Wild Petunia is not related to the popular cultivated border plant. It can be propagated by seed planted in the spring and given protection until the second year. Then the seedlings may be planted in the open.

Salvia coccinea, Red Flowered Sage - This plant is a tender annual. The seed should be planted in the greenhouse or cold-frame early in the year, then transplanted to the open when all danger of frost has passed. When planted the seeds must be covered thinly with soil. They will not germinate if exposed to light.

Sanguinaria canadensis, Bloodroot - This is one of those early spring bloomers, the seed of which must be planted as soon as ripe. If allowed to dry the percentage of germination will be very low.

Sarracenia species - Pitcher Plants or Trumpets can be grown from seed, kept dry over winter and planted in the open in moist soil or preferably wet sphagnum moss in the spring.

Sedum species - Stonecrops are found in both upright and prostrate forms. The former is grown from seed planted in the spring. Division by cutting the stems most easily increases the prostrate forms.

Shortia galacifolia, Oconee Bells - This plant is propagated by division of rootstocks or by seed. To produce seed, cross-pollination must occur between plants of different clones. The seed must be planted immediately after ripening. The seedlings should be protected for at least a year after germination before being set in the open. It is a good ground cover.

Silene virginica, Fire Pink - This is a perennial plant grown from seed. Seed should be collected as soon as mature. Sow seed on mixture of one-half commercial potting soil and one-half coarse sand. Moisten soil and cover flat with glass and set in shade. Germination should occur within ten days. When seedlings reach transplanting size, they can be set out in the desired location for over-wintering and spring bloom.

Silphium perfoliatum, Rosinweed or Cup plant - This plant can be propagated by dividing root sprouts.

Solidago species - The Goldenrods including Sweet Golden Rod, *S. odora*, are frequently grown in sunny gardens. After they ripen in late August or September seeds will germinate in about two weeks. If kept in the greenhouse young plants can be transplanted outside in late spring. Root and rosette divisions are also good propagation methods.

Spigelia marilandica, Pink Root or Indian Pink - This plant can be grown from seed kept dry over winter and planted in the spring, provided the seed can be obtained. The blossoms open one at a time, and seed formation follows the same sequence. A piece of netting tied over green seed capsules will retain seeds as they ripen and fall out.

Swertia caroliniensis, Frasiera or Columbo - These can be grown from

seed planted when ripe. The seedlings grow slowly and will probably not bloom until the third year, after which the plant dies. It is therefore called a triennial.

Thalictrum species - The Meadow Rues may be grown easily from seed. *T. thalictroides*, the Rue Anemone, forms a small tuber similar to a dahlia and may be propagated by division of this tuber.

Thermopsis villosa, Bush Pea or Carolina Thermopsis - New plants can be grown from seed stored dry over winter. Seedlings may be set in the open in late summer of the first year.

Trillium species - Trilliums can be grown from seed which can be very successful, however, seedlings take five to seven years to fruiting. Seeds are best planted in pots of 1/3 peat, plus 1/3 sand, and 1/3 Trillium population soil (woods dirt) taken from the vicinity of parent plants. Pots prepared, planted and labeled should be dug into the ground up to the cuff in September. Slating or some other protective cover should prevent the pot soil from washing. Pots should be watered if insufficient precipitation occurs in winter. Seeds will be naturally cold treated and should emerge along with mature plants in late March, April, or early May. Do not disturb them during the first growing season. Only one leaf forms the first year. The seedlings (tiny rhizomes) may be separated as they die back at the end of their spring growing season. It is best to plant numerous seeds. Never winter either Trillium plants or seeded pots in a greenhouse. There is dormancy associated with both the embryo plant and the adult bud that can only be broken by low temperature treatment. The refrigerator is not successful. They must freeze and thaw and chill.

Verbascum species - The Mulleins are biennials. Seeds planted as soon as ripe may germinate before cold weather sets in, but germination usually takes place the following spring. Spring planted seeds should bloom the following year.

Verbesina encelioides, Golden Crown-beard - This plant is annual and seeds should be collected in the fall and sown in flats to be set outdoors after danger of frost.

Veronica officinalis, Speedwell - Propagation by stem cuttings which

root rapidly in sandy loam. Makes a good ground cover.

Yucca species - Spanish Dagger or Spanish Bayonet can be grown from seed planted immediately after ripening in light shade and kept moist. They will germinate in one season. Division of branched plants is also possible.

Zephyranthes species - The spring blooming Atamasco Lily, *Z. atamasco*, and *Z. candida*, the summer blooming species naturalized from cultivation in some of the eastern North Carolina counties, are both easily multiplied by separation of the bulbs as they begin to go dormant.



Propagation of Specific Trees Shrubs and Woody Vines

Abies fraseri, Fraser's Fir trees are best propagated by means of seeds sown in early spring in flats or seedbeds in the open. They germinate readily the first season. Stratification for 3 months at 30° F improves germination.

Acer species - Maple trees are best propagated from seed, which should be planted as soon as it ripens. All trees of this genus have very dense roots near the surface and will invade and obstruct any drain or sewer line in the vicinity.

Aesculus species - Buckeye seeds should be planted as soon as ripe. During warm weather of late summer a root develops. Then all growth stops until after a season of cold. When the temperature begins to rise in the spring the top growth is initiated. Seeds must be protected from squirrels.

Amelanchier species - Serviceberry or Shadbush, can be rooted from early spring hardwood cuttings or softwood cuttings taken in the summer. Seeds should be stratified for 8 weeks and sown shallowly in finely textured soil. Clump division may increase stoloniferous species. Stolons may be dug, cut and planted in a sand and peat soil mixture.

Amorpha fruticosa, Bush Indigo is a shrub of the pea family, which is apt to become weedy. Propagation is by seeds stored at room temperature and planted in spring or by root cuttings or division of clumps.

Ampelopsis arborea, Peppervine is propagated by seed sown in early spring. It may also be rooted by hardwood cuttings taken in early spring. Layering of runners is also a good way to obtain new plants.

Anisostichus capreolata, Crossvine is propagated by seed sown when ripe or by cuttings taken in early winter or spring.

Aralia spinosa, Devil's Walking Stick or Hercules' Club seed may be

planted in the fall, but shoots develop readily from roots and may be dug and planted.

Aristolochia macrophylla, Dutchman's Pipe can become a nuisance, due to its habit of climbing and strangling trees on which it climbs. Seeds stored over winter at room temperature and planted in spring can be used to propagate it.

Asimina species - The Paw paws seed can be taken from fruit, dried for several days, stratified for three months and then planted. The spreading superficial roots of *A. triloba* give off suckers which transplant satisfactorily especially when the root is severed one to two feet from the sprout one season before moving.

Betula species - The Birches are readily grown from seed planted as soon as ripe.

Buckleya distichophylla is a dioecious shrub that must have its roots in contact with Canada Hemlock (*Tsuga canadensis*) roots. Sow seeds under Hemlock trees, where the plants will have sunlight.

Bumelia species - The Buckthorns can be propagated by seed sown in shade. also easily rooted from cuttings set in the open in the fall.

Callicarpa americana, Beautyberry seed planted in fall germinate the following spring. Alternately they may be stratified for 10 weeks in a refrigerator before planting. Can also be propagated by cuttings, especially the white form.

Calycanthus floridus, Sweetshrub is readily grown from seed, planted when ripe or saved until spring. Stratification for two months gives the best results. Clump division is also possible. Softwood cuttings root easily.

Campsis radicans, Trumpetvine can be grown from seed planted as soon as ripe in late summer. Vines take about 3 years to flower. If untended it may become a nuisance.

Carpinus caroliniana, Ironwood or Hornbeam is propagated by seed sown in the open in either fall or spring.

Cassandra calyculata, Leather-leaf seeds germinate readily when planted shallowly in finely textured soil as soon as ripe. Stratification for 2 months improves germination.

Castanea species - Chestnuts and Chinquapins require the same treatment as Buckeyes (*Aesculus*). They must be planted as soon as mature, so as to develop a root system during late summer and fall. Flats and seedbeds must be protected by wire screening from mice and squirrels. Chinquapin (*C. pumila*) has been grown successfully by placing seeds in closed plastic bags in a dark warm place. When sprouted, they are then planted in peat pots and fed lightly to strengthen them for planting outside. Seeds of *Castanea* must be collected as soon as they fall to the ground. If not sown immediately, they should be stratified for 3 to 5 months at 30-35° F.

Catalpa species - Indian Cigar Tree seeds can be stored dry over winter and planted in spring.

Celtis species - The Hackberries seeds may be planted in fall or early spring.

Cephalanthus occidentalis, Buttonbush is propagated by seed sown when ripe or by softwood cuttings taken in early summer.

Ceratiola ericoides, Wild Rosemary cuttings taken in late July can be rooted in semi-shade under glass or in a cold-frame.

Cercis canadensis, Redbud seeds need several months of stratification followed by scarification. Alternatively they can be planted outside 1/2 to 1 inch deep in the fall. They will germinate the following spring.

Chamaecyparis thyoides, Atlantic White Cedar is easily germinated if seeds are given 2 months of cold treatment before planting.

Chionanthus virginicus, Fringe Tree is grown most readily from seed planted in the fall or in the spring. Germination is improved by 2-3 weeks with warm stratification at 50-70°F followed by 2 months cold stratification at 30-35°F.

Clethra species - The Sweet Pepperbushes are easily grown from seed planted in the spring. Seeds planted in the fall in a cold-frame germinate in spring. Division of mature plants is a faster method of propagation. Propagate by softwood cuttings under glass in half-shade.

Cornus species - Seeds of Dogwoods should be cleaned and stratified at 40°F until spring. Plant in flats or in the open. Germination may not take place until the following year. Stem cuttings taken in early summer will root in a few weeks. Flowering Dogwood, *C. florida*, seeds are hard and germination is better if seeds are stratified 3 months and scarified before planting. Layering of lower branches may propagate unusual forms. Rooted branches can be transplanted in one year, but it is best to wait two or three years. Some forms root more readily than others do.

Corylus species - The Hazelnuts are easily grown from seed, which should be planted in the open as soon as ripe, or stratify seeds at about 30°F for 10 weeks and scarify before planting. Protect from rodents. Germination will take place the first season. Shoots may be taken by division and planted. Pouring boiling water over the seed and allowing them to stand overnight also helps to promote germination. Plant seeds in partial shade and keep moist until they germinate.

Crataegus species - Hawthorns respond to techniques for propagating apples. Stratify seed for 8-10 weeks at 30-40°F before planting.

Cyrilla racemiflora, Titi can be propagated by softwood cuttings taken in early spring.

Daubentonia punicea, Rattle Box or Red-Locust seed must be made permeable by scarification or by pouring scalding water over them and soaking overnight. Germination occurs within two weeks.

Diervilla lonicera, Bush Honeysuckle seed can be planted in the spring and will germinate in late summer.

Diospyros virginiana, Persimmon seeds are removed from ripe fruit in fall, cleaned, dried, and stratified at 30°F for 3 months before

planting. Seed can be planted directly in the fall, however, but the percentage of germination is much lower.

Euonymus americanus, Hearts-a-Busting or Wahoo is propagated by seed cleaned, stratified at 40°F for 10 weeks, and planted in spring.

Fagus grandifolia, American Beech seeds need 3 months cold stratification at 30-35°F before planting.

Fothergilla major, Witch Alder throws the seed several feet when the capsule opens. Seed should be collected as they ripen, given moist stratification over winter, then planted in the spring.

Franklinia alatamaha, Franklinia seed should be stratified for two months as soon as ripe and planted immediately in a peaty mixture in semi-shade. Cuttings from new wood can be rooted under glass in semi-shade. Dormant cuttings can be taken in late winter root if a rooting hormone is used.

Fraxinus species - Ash trees seeds can be planted in fall and will germinate well the following spring.

Gelsemium sempervirens, Yellow Jessamine can be propagated by seeds, when they can be found. Stem cuttings root readily in early summer.

Gleditsia triacanthos, Honey Locust seed should be cleaned and stored at room temperature until spring. Before planting, file a nick in the seed coat or pour boiling water over the seed and soak overnight.

Gordonia lasianthus, Loblolly Bay can be propagated in a very moist covered bed or greenhouse or by stem cuttings taken in August or September.

Gymnocladus dioica, Kentucky Coffee Tree is best propagated by seeds which must be cracked or filed or have a hole drilled in the seed coat before satisfactory germination occurs. Stratification for 2 months at 35°F before scarification improves germination if fruit did not mature completely on the tree.

Halesia species - Silverbells are difficult to propagate and neither stem nor root cuttings are reliable. Seed stratified at 70°F for 3 to 4 months, followed by stratification at 35 to 40°F for a like period prior to planting, gives satisfactory results.

Hydrangea arborescens, Wild Hydrangea has minute seed that will germinate well if planted in a moist location as soon as ripe.

Ilex species - The Hollies respond to different treatments, depending on whether they belong to the evergreen or deciduous species. All species, however, may be grown from seed, which must be cleaned and stratified at 40°F for about 2 months and planted in spring. Germination usually takes place the following year but may be delayed until the second year. Stem cuttings of evergreen species taken from mid-July through August should take root by spring, if kept in a cold frame or greenhouse. If a cold frame is used, cuttings should be left for 2 years before transplanting. Cuttings can also be taken throughout the winter. Deciduous hollies spread by underground roots (stolons). These may be dug and planted to give rise to a new plant.

Itea virginica, Virginia Willow seed can be planted in soil when ripe and kept in a cold frame over winter. It should germinate the following spring.

Juglans species - Walnuts should be hulled and planted as soon as they are ripe. Root growth will begin before cold weather and top growth will start in the spring. Seedbed must be protected from squirrels using screen or wire mesh.

Juniperus virginiana, Juniper or Red Cedar may be grown from seed if stratified for 5 months before planting. The most satisfactory propagation is by stem cuttings taken with a short 'heel' in early winter after frosts have hardened the growth of the current season. Rooting should take place by early summer.

Kalmia species - Laurel species are grown most easily from seed planted in flats in early winter and kept in a cold frame until spring. Allowing seed to freeze in winter before stratifying 2 months improves germination. Seedlings are tiny and temperamental and

should be given protection until the following year. Softwood cuttings taken in summer and treated with hormone take root satisfactorily.

Leiophyllum buxifolium, Sand-myrtle can vary in its habit of growth, depending on the habitat. In the Piedmont area they grow upright, while at elevations of 4,000 feet or more the growth is prostrate. Propagation is by seed sown in early winter. Seed taken from plants growing at high elevations seem to give better germination if stored for ten days to two weeks in the freezer.

Leucothoe species - These Heath family members occur in both evergreen and deciduous species. Seed sown in either fall or spring best propagates the deciduous ones. Stem cuttings of the evergreen species taken late in the year should be rooted by early summer.

Lindera benzoin, Spicebush seed should be taken when ripe, cleaned, stratified from 30-40°F and planted in the spring. They will germinate quickly that season. The main stem can be cut back to allow shoots to develop that may be removed with a root and planted.

Liquidambar styraciflua, Sweet-gum seed are taken from the spiny fruit in fall and planted out of doors, germinate in spring.

Liriodendron tulipifera, Tulip Tree seeds can be planted in fall and will germinate in spring.

Litsea aestivalis, Pond Spice can be propagated by softwood cuttings placed in semi-shade under glass.

Lonicera sempervirens, Coral Honeysuckle seeds must be cleaned of the fleshy covering and stratified at 40-50°F for 2 months before planting in spring. Stem cuttings taken in mid-summer take root in a matter of weeks.

Lyonia species - Fetter-bush or Stagger-bush includes both evergreen and deciduous species. They are propagated by storing seeds at room temperature and planting them in spring.

Maclura pomifera, Osage Orange is propagated by removing the seed from the fruit as soon as ripe and planting immediately. Germination

may take place the first season but may be delayed until the following year.

Magnolia species - Magnolias seeds must not be allowed to dry. Remove pulpy covering and stratify at 40°F. Plant immediately or in early spring. Germination will take place in a few weeks, but seedlings need some protection until the following spring. Stem cuttings of the deciduous species taken in late spring or early summer as the new growth begins to harden will take root if treated with a mild hormone. Cuttings of evergreen species root if taken from young plants when the new growth has hardened.

Morus species - Mulberries seeds must be removed from fleshy fruit in early summer. When dried and planted it will germinate in spring.

Myrica species - Wax Myrtle and Bayberry can be grown from clump divisions or seed which are stratified for 4 to 6 weeks before planting.

Nestronia umbellula, *Nestronia* is parasitic on tree roots. It can be propagated by planting seed among trees.

Nyssa species - The seed of the more familiar species of Gum or Tupelos (*N. sylvatica*, *N. aquatica*) respond to cleaning, stratification, and planting in early spring. The Ogeechee Plum (*N. ogeche*), however, requires a period of warm stratification-3 months at 70°F followed by stratification at 40°F for a like period of time. When planted in spring germination should take place the first year.

Osmanthus americana, Wild Olive may be rooted from late winter cuttings using a hormone or increased by division of shoots.

Ostrya virginiana, Hop Hornbeam seed should be stored at room temperature and planted in the spring.

Paxistima canbyi, (also *Pachystima*), Cliff-Green or Mountain-Lover is an attractive evergreen ground cover propagated by short stem cuttings taken in summer and grown in sand in a cold frame under glass.

Philadelphus species - Mock Oranges can be propagated best from

stem cuttings of new growth taken in early summer.

Physocarpus opulifolius, Ninebark is propagated from stem cuttings of new growth taken in July or from seeds stratified for 2 months and planted in a cold frame.

Picea species - Spruce seeds should be kept over winter at room temperature and planted in spring. They will germinate in a few weeks.

Pieris floribunda, Mountain Andromeda seed should be stratified for 3 months and sown very shallowly, in a 1/2 sand, 1/2 peat medium. Keep very moist. Cuttings root easily if taken in late winter and a hormone is used.

Pinckneya pubens, Fever Tree propagated by seed sown in early spring and given protection until the following year.

Pinus species - Pine seeds are best planted in the open as soon as they mature. Alternately they may be held over winter at room temperature and planted in the spring. Seed also germinate readily if given 6 to 8 weeks cold treatment at 30-35°F before planting or if planted outside in fall. Pines will root if short cuttings (1-2 in. long) taken from terminal ends of stems are treated with a hormone.

Platanus occidentalis, Sycamore seeds from dry round fruits can be planted in fall germinate in spring. Not all of the seeds will germinate.

Poncirus trifoliata, Trifoliolate Orange seeds should not be allowed to dry. Plant in flats in the greenhouse, or other protected place, as soon as the fruits ripen.

Prunus species - Wild Plum and Cherry seed should be planted in the open as soon as ripe or stratify for 10 weeks before planting. They are difficult to root. Shoots produced on lateral roots may be used if a piece of root is attached.

Pyrularia pubera, Buffalo Nut is a parasitic shrub that seems to thrive when its roots are in contact with those of *Calycanthus*, although it is sometimes found growing under other trees. Seeds planted under

Calycanthus as soon as ripe give good results.

Quercus species - Oaks respond to the same treatment given similar fruits. Acorns must be planted outside as soon as ripe or stratified until planting in spring. The root system will develop during warm weather and top growth will begin the following spring. Some evergreen oaks root with use of hormone. Cuttings taken from young trees are most successful. Deciduous species are difficult or nearly impossible to root.

Rhamnus species - Buckthorns seed should be planted in the open as soon as ripe, germination occurring the following spring. Seed may also be stratified when ripe and planted in the spring.

Rhododendron species - Rhododendrons, and Azaleas (which are deciduous Rhododendrons) are easily raised from seed, although this method is rather slow. Seed requires no special treatment but should be planted shallowly in a mixture of fine sand and peat. Transplant 3-4 months after germination. The evergreen species can be propagated by stem cuttings of the current season's growth taken in August or September. Use of a rooting hormone is helpful. Keep cuttings shaded. Of the deciduous species, the Flame Azalea (*R. calendulaceum*) seems to be the most difficult. Cuttings from these plants taken in early summer will usually take root in a few weeks, but few of them will survive the first winter unless facilities are provided to lengthen the growing season by artificial light and heat. Other deciduous species are much easier to handle. Stem cuttings taken in early summer should develop a good root system before the weather turns cold. The rooted cuttings should be kept in a protected place during the first winter. Layering is an effective means of increasing especially desirable forms.

Robinia species - Locust tree seed may be stored at room temperature for the winter and planted in the open in early spring. Boiling water poured over the seed and allowed to stand overnight or scarifying the seed by rubbing between two pieces of sandpaper seems to help germination. Most Locusts are stoloniferous and may be propagated by root cuttings taken in late winter or early spring.

Rosa species - Roses seed should be taken from the hips as soon as

ripe and planted in the open or stratify seeds for 3 months before planting. For propagation by stem cuttings, select a stem that has just produced a bloom. Remove the fruit and take the cutting with a short heel. Roots should form promptly.

Salix species - Willows very easy to root by taking cuttings in late winter. Use a 1/2 sand and 1/2 peat medium.

Sambucus species - Elderberries are stoloniferous, so root cuttings provide the best method of propagation. Seed may be stratified over winter and planted in spring.

Sassafras albidum, Sassafras should be propagated from seed stratified over winter and sown in spring.

Smilax species - Includes Cat-, Green-, and Sawbriers, and Carrion Flower. The seed should be cleaned and stratified at 35-40°F for 10 weeks for spring planting. Scarification improves germination.

Sorbus species - Mountain Ash and Chokeberry are in this genus. Seed should be cleaned and stratified at 40°F as soon as ripe. Plant in early spring. Germination will probably not take place until the following year.

Staphylea trifolia, Bladder Nut seed should be stored dry at room temperature and planted in spring.

Stewartia species - Mountain and Silky Camellia seeds are difficult to germinate. If given 2 months warm (above 40°F) and 3 months cold (25-30°F) stratification, some germination occurs. Or gather seeds when they mature and plant in a medium of 3 parts sand to 1 part peat. Keep under glass in semi-shade. Cuttings may be taken as soon as new wood is firm in summer or early fall and kept under glass in semi-shade. Use of a hormone improves rooting. Do not transplant for about 2 years. Layering of lower branches is another means of propagation.

Styrax species - Storax seed can be stored at room temperature and planted in spring. Alternating cold and warm stratification 3 or 4 times until spring improves germination. Cuttings of new growth

when firm, set in sand or vermiculite under glass in semi-shade root readily.

Symphoricarpos species - Coralberry and Snowberry root easily from late winter cuttings. Seeds planted in fall germinate in spring.

Symplocus tinctoria, Sweet Leaf or Horse Sugar is difficult to propagate. Cuttings taken in early spring give fair rooting results.

Taxodium distichum, Bald Cypress seed should be planted in the open in spring. Germination may be rather slow and is improved by stratifying for 3 months at 40°F and sowing seeds in peat moss or aged sawdust.

Taxus canadensis, Yew the best method of propagation is by stem cuttings taken in July. The use of a rooting hormone improves results. Seeds, if available, germinate rather slowly. Stratification for 3 months at 50-60°F and 4 months at 35-40°F improves germination.

Thuja occidentalis, Arbor Vitae seed planted outside in the fall germinate in spring. Same germination results if given 2 months stratification. Cuttings taken in late winter root readily with a hormone.

Tsuga species - Hemlocks are readily propagated from seed sown in early spring. Three months stratification increases germination. Rooting of cuttings is difficult.

Ulmus species - Elms are propagated from seed planted as soon as ripe. Planted in the open they should germinate the following spring. Seed produced in early spring germinate immediately.

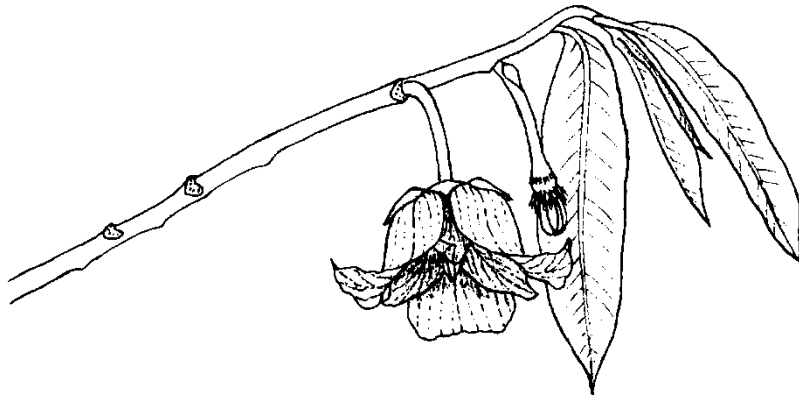
Vaccinium species - Deerberry, Blueberry, and Cranberry all germinate from seed cleaned and stored dry over winter and planted in spring.

Viburnum species - Viburnums can be propagated from seeds planted in midsummer after ripening, which will germinate the following spring or stratified over winter and planted in spring. Late winter stem cuttings root readily. Early summer stem cuttings of most species root

in a few weeks.

Wisteria frutescens, American Wisteria the only native species of this genus. Seed should be kept at room temperature over winter and planted in the spring. Seedling growth is rather slow for the first two or three years. Vines layer readily.

Zenobia pulverulenta, Honey-cup seed should be kept over winter at room temperature and planted in the spring. Seed should be stratified for 8 weeks prior to sowing shallowly in finely textured soil. It can be rooted from early spring hardwood cuttings or softwood taken in summer. Shrubs spread by stolons that may be dug, cut and planted in a sand and peat soil mixture.



Section 4: Two Dozen Recommended Native Plants for Easy and Lasting Cultivation

Aquilegia canadensis, Columbine is one of the easiest and most rewarding of all wild flowers to cultivate. It self-sows seeds in both sun and shade, though the more sun it receives the more densely it grows and the darker the coloration. In addition to the beauty of its distinctively shaped flowers, which attract hummingbirds, another bonus is the evergreen foliage, which, during a normal winter, forms lush green mounds, in a rock garden, along woodland paths or in perennial borders.

Asclepias tuberosa, Butterfly Weed is very drought resistant and provides brilliant orange or yellow-color in mid-summer. It will usually bloom a second time in late summer if the first flowering stems are cut back near the base at the end of the first flowering.

Asplenium platyneuron, Ebony Spleenwort is one of our most common ferns found growing in woods and fields in shade and sun alike. It is also drought-resistant and a good evergreen plant for rock or shade gardens.

Aster divaricatus, *A. grandiflorus*, *A. dumosus*, and *A. pilosus* are only a few of the many common fall blooming asters which English gardeners tamed in their perennial borders long ago. They are excellent in their drought resistance and show of white and brilliant blues well past frost in late fall. During the summer, the white frost asters provide a healthy shrubby effect at the back of the flowerbed. It may be necessary to cut very vigorous specimens back in early summer to keep them from falling over as fall approaches. Many of the blue asters are scrubby in appearance so they should be placed where they are not noticed during the summer and allow the brilliant blue flowers appear from unexpected corners at frost time.

Bidens polylepis and *B. frondosa*, Beggar's Ticks are available as seed in many large-flowered forms. Their golden yellows are unequalled at the end of summer. Scatter seed in flowerbeds so as to have several nice clumps throughout. Then broadcast seeds along the lawn's edge

or long drive for a really spectacular roadside effect. Some enthusiasts have already learned to recognize the seedlings growing naturally along their roadsides and leave un-mowed strips along the edges of their lawn for nature to provide a fall garden.

Campsis radicans, Trumpet Vine is considered by most to be a burdensome weed; however, it can be restrained to a few fence posts along the yard's edge or appropriately placed around the perennial garden. The summer-blooming trumpet-shaped flowers in orange, red, or yellow are attractive and will attract hummingbirds. The effect of the leafy stems is also interesting as the plant mushrooms out and drapes from the top of the fence post support.

Chrysogonum virginianum, Green and Gold is one of the most lasting of native plants. If winters are not too severe and it has ample sunlight this little plant provides quarter-sized golden daisy-like flowers almost ten months each year. It is excellent for the rock garden or a semi-sunny spot in the woodland wildflower garden and even as a pot plant.

Daucus carota, Queen Anne's Lace is easily established in the flower garden by dropping seeds during late summer where you want the plants, or by simply transplanting young plants in late fall or every spring before the root has become too long. Once established there always is some to move around from place to place in the garden. No other plant can give such lacy effect in combination with coarser plants. It is also an excellent cut flower for summer bouquets. English colonists introduced this species to North America.

Gelsemium sempervirens, Yellow Jessamine frequently flowers early enough to have a beautiful covering of snow on it. Its fragrance and warm golden yellow color is a true indicator that the growing season is well upon us. It is perhaps our most versatile native in that it can be trained on fences, mailboxes, gates, trellises and walls, or headed up a tree trunk wisteria-like without the strangling effect or simply allowed to sprawl on the ground for an evergreen carpet effect. It normally gives a profusion of flowers in full and part sun.

Helianthus tomentosus, Wild Sunflowers are drought resistant and sun loving. There are many different species including the beautiful and

tasty Jerusalem Artichoke, *H. tuberosus*. is extremely tall and most likely will require staking. If room will spare it, however, just let it lean to the sides for a more graceful effect when it flowers in late summer. An added feature will await you as the seeds begin to arrive, for then you will see Gold Finches riding up and down as they eat the small version of our commercial sunflower seed.

Heterotheca mariana, Maryland Golden Aster provides a sturdy low rosette effect until late summer when floral stems lift clusters of golden aster-like flowers about a foot off the ground. They will flower in semi-shade but perform much better in full sun. It makes an excellent border along flowerbeds or along the woodland edge. The fruiting heads make good dried arrangements for the winter months.

Houstonia purpurea, Bluet is a seldom-cultivated member of the group is a fine specimen plant for sunny rock garden or for shady woodland garden. In the mountains, high elevation weather maintains it as a low tussock, but down in the hotter bottomlands it may get as tall as ten inches. With ample sun and some moisture it blooms profusely throughout the summer.

Liatris spicata, Blazing Star or Gay Feather is one of the most striking flowers of the late fall garden. Grow it with late blooming Goldenrod and you will love to see the summer end. Many *Liatris* are found on very dry soil, but this one likes extra moisture during dry periods and will reward you with spires often found to six feet tall. You can still grow it next to the dry Goldenrods, just remember to direct some water its way as you walk by your bed with the watering can or hose.

Lobelia cardinalis, Cardinal Flower, and *L. siphilitica*, Great Blue Lobelia are both easy to grow members of the perennial bed. Mulch well around the plants to conserve soil moisture if you cannot locate them in a normally damp or wet spot, and include them with other plants you tend to pamper with water during dry spells. Also, in spite of the fact that Cardinal Flower does well in full sun, its color is much more brilliant if set back just a bit into a shady corner where it gets perhaps only a half a day of sun or filtered sunlight. This is another hummingbird attraction. The Blue Lobelia will tend to fall to the side and produce many lateral flowering branches with a candelabra effect. Put it in a spot where it can be allowed to fall over, for it looks much

better in this natural posture than being staked.

Lonicera sempervirens, Coral Honeysuckle, as its species name *sempervirens* describes, is an evergreen and bears all the attributes of the Yellow Jessamine but has clusters of thin tubular vivid red flowers. It does not become a pest, as does the invasive introduced Japanese Honeysuckle (*L. japonica*). Several especially attractive forms are available in the nursery trade.

Monarda punctata, Horsemint is a beautiful native mint seldom seen cultivated in gardens. Perhaps its ease of propagation and drought resistance cause people to turn up their noses. However, the rare combination of yellow and brown flowers set upon frosty pink leafy bracts make this a striking mint for display. It blooms from August past frost. They are grown to best effect if several are clumped together in an area where it will get at least half a day of sunshine. It makes an interesting pot plant, also, but remember to protect the pot in a cold frame or mulch into the ground during winter months.

Osmunda cinnamomea, Cinnamon fern, and Royal Fern, *O. regalis* var. *spectabilis* are hardy wet area plants for both sun and shade. One of spring's most striking sights in the woodland garden is the uncurling of the waist-high fuzzy "fiddle heads", or croziers, as young cinnamon fern leaves are called.

Passiflora incarnata, Maypop or Passion Flower has one of the most intricately structured flowers of any North Carolina plant. It creates continuous interest throughout the growing season. Since it is easy to grow anyone with a sunny area and room to let it ramble over a fence or trellis should try it. Passion Flower is very aggressive so make certain there is ample room or confine it to a high wall to climb on. The green egg-shaped fruit are very pleasant to smell when ripe in late summer and fall after they have turned yellow. There are several natural food books containing recipes for jellies and sauces.

Penstemon species - Beard Tongues occur as several species and varieties in North Carolina. It is difficult, however, to distinguish several of the species, so leave the nomenclature problems to the taxonomists and enjoy the propagation and cultivation. They may flower a second time if cut back at the end of their first flowering in

late spring or early summer. You can also take advantage of their evergreen basal clumps of foliage, which in many species turn a maroon color during the winter months. As you work with the various forms, experience will teach you that some may become three to four feet tall and should be at the back of beds while others will remain low enough to plant in the forefront.

Polystichum acrostichoides, Christmas Fern is one of the most common native ferns and is excellent for the shady wildflower garden or for edging effect in shady area of a formalized garden. Thousands are being destroyed by development and a little careful exploring in your local area will possibly open up such a site for an organized group plant rescue after appropriate permission is obtained. While you are digging, take each large clump and divide into several smaller clumps. Kept in the shade and given ample moisture during dry periods, each small clump will be as large as the original clump within a year or two.

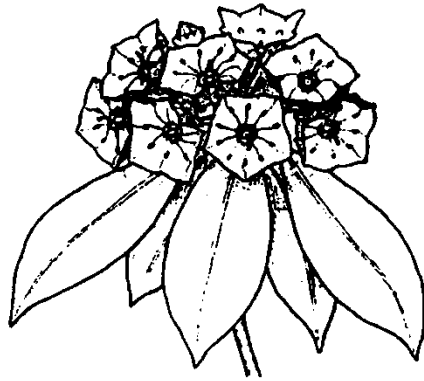
Rudbeckia hirta, Black-eyed Susan is a variable species, blooming during the summers and persisting in the garden if care is taken to protect the basal shoots during the winter. Other species such as *R. fulgida* have smaller flowers, bloom much later, persist past frost, and are generally as attractive as their larger cousin.

Solidago species - The Goldenrods are a large and common group of plants. Not enough can be said concerning the many species of North Carolina Goldenrods moved long ago to perennial gardens in England and the European continent. Goldenrods do not cause hay fever; they have for too long been wrongly accused for the pollen problems created by several species of Ragweed (*Ambrosia*) which bloom during the same period and are never noticed because their flowers have no colorful petals and produce wind-scatter pollen. Utilizing N.C. species of Goldenrod, a garden could be assured of having gold colors from mid-July through early November. To mention just a few, *S. gigantea* and *S. altissima* are two of our tallest species, which require a sunny site behind other plants. Also, keep in mind that the general height of species grown at high mountain altitudes may substantially increase when propagated and grown in the central and eastern areas of the state. The Seaside Goldenrod, *S. sempervirens*, which normally grows about 2 feet tall on the coastal sand dunes

reaches 6 and 7 feet when cultivated inland. This is one plant that you need not fertilize nor water. *S. rugosa* is commonly found in moist areas, but is easily cultivated in sunny beds. The basal offshoots make an attractive evergreen ground cover during the winter. Though seldom, if ever, cultivated, it may be the finest Goldenrod for home gardens because it remains strictly erect even when it reaches 4-5 feet in height. The effect of this plant is a multi-trunked umbrella that offers a subtle yellow-green color in late summer before turning golden when in full flower. It remains erect and attractive even as it stands in the winter landscape.

Thelypteris kunthii, Southern Shield Fern is a commonly cultivated fern of the South, which is currently known from only one North Carolina location. Under cultivation, this fern has proved to be one of the best. It volunteers in a shady moist greenhouse from spores and in moist shady areas outside it remains green and active until the temperature drops to 20° F. It is also an excellent pot plant indoors or outside as long as it is not allowed to dry out or sun scorch.

Verbascum thapsus, Woolly Mullein though a common roadside weed, is valued for its distinctive evergreen cabbage-like gray-green fuzzy leaves. The tall dried fruiting stalks that follow the yellow flowers are useful for fall dried arrangements.



Section 5: Native Plant Suppliers

There are many sources for native plant material for your garden and projects. These include seed and plant catalogues, local nurseries and garden shops. Also, many of the public and private gardens in this area sell plants or seed as a service or a fundraiser. It is your responsibility as a wildflower enthusiast to be sure that the plants or seed you buy have been produced in a legal and ethical manner. This generally means that they have been nursery propagated and have not been collected from wild populations. As the purchaser you should be sure of the plants that you buy, if you have any question as to the original source, ask the seller! If they can't or won't tell you that the plants were ethically propagated, then take your business elsewhere!

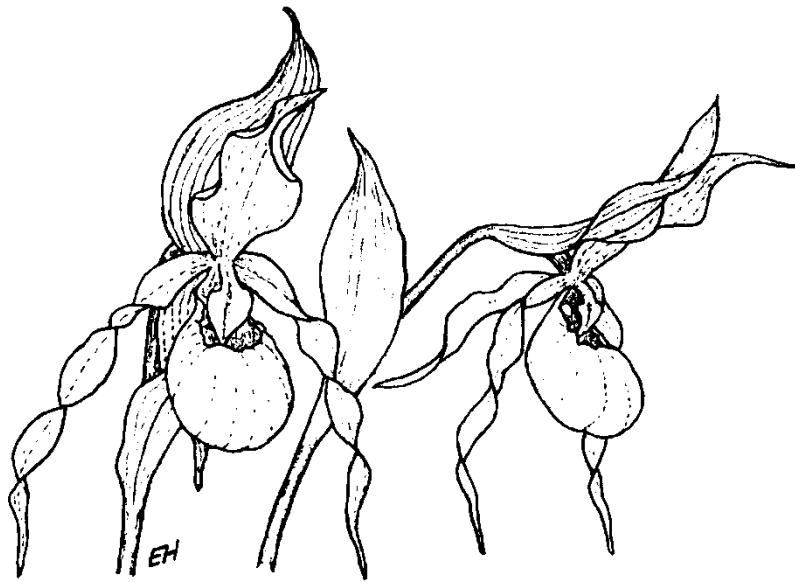
It has long been known that some species adapt well to being grown in another location, and other species decline in vigor if removed from their native conditions. Conversely many plants may become aggressive pests when removed from the natural controls of their native environment. For this reason, the North Carolina Botanical Garden has developed a policy to promote seed distribution in our region. They will no longer distribute seed outside of the 12-state region of the Southeastern United States. The goal is to promote an appreciation of each regions unique flora and to minimize the chance for spread of exotic alien plant species. It is hoped that all horticulturists and gardeners interested in native plants will also adopt this standard and buy plants from within our southeastern bioregion.

The North Carolina Wild Flower Preservation Society endorses this policy and promotes the use of native plants from our region. As a service to the citizens of our state, the North Carolina Botanical Garden can provide a list of recommended sources of native plants. This list provides addresses and contact information for about 50 nurseries that propagate their own plants. To get a copy of the updated list of recommended plant sources send a self addressed, stamped envelope to the North Carolina Botanical Garden, The University of North Carolina at Chapel Hill, CB 3375, Totten Center, Chapel Hill, NC 27599-3375.

Additional suggestions of native plant and seed suppliers for our region can be obtained from the National Wildflower Research Center, 2600 FM 973 North, Austin, Texas 78725-4201. Phone 512-

929-3600 and ask for the southeast area sources list and native plant bibliography.

You can support the environment by supporting nurseries that propagate native plants. Not only will you be helping to conserve native populations, nursery propagated plants are more likely to survive and thrive in your garden.



Section 6: Exotic Plant Pests

Recently concern has arisen regarding the introduction of exotic alien species. As we increase our connections with the global marketplace we increase the risk of introducing an exotic weedy species that can cause a wide range of environmental disturbance. Plants that are manageable and well behaved in one location may become weeds and pests in another region. Plants have adapted to thrive in the environment and habitat in which they naturally occur. Some plants, however, become aggressive and prolific when introduced to a new environment, which does not contain the natural controls which keep the plant in check, and this can cause serious ecological problems. Many species introduced as garden specimens have escaped to woods and wetlands to the detriment of local natives. It is hard to predict which plants will have this dangerous propensity. Some of our common natives are pests in other regions and their natives may become weeds in our region.

Invasions by non-native plant species are an increasing concern throughout the world. Many examples are now documented of plants that can totally transform natural communities. This transformation is usually to the detriment of native plant and animal species, and human land uses. Exotic plants effect woodlands, open meadows, wetlands, farms and urban properties. Many people now find they are spending significant time and resources combating the invasion of weedy alien species.

Many agencies and groups responsible for land management have had to develop plans that include managing invasive plants. In most cases managing invasions of aggressive, weedy exotic species is both difficult and very expensive. In some cases removing an invasive alien plant from an ecosystem is even impossible. In addition new exotics are still being introduced, some of which will become problems we don't yet realize.

Throughout the Southeast United States there are over 200 plants that have been identified as invasive exotics. Depending on the ecoregion and habitat, a mixture of these species occurs almost everywhere. Most agencies and experts have reported a particular "dirty dozen" list of species that pose the greatest ongoing and generally widespread threat to our native habitats:

Ailanthus altissima, Tree of heaven
Albizia julibrissin, Mimosa
Alliaria petiolata, Garlic mustard
Celastrus orbiculatus, Oriental bittersweet
Elaeagnus umbellata, Autumn olive
Ligustrum sinense, Chinese privet
Lonicera japonica, Japanese honeysuckle

Microstegium vimineum,
Japanese grass
Miscanthus sinense, Plume grass
Pueraria montana, Kudzu
Rosa multiflora, Multiflora rose
Vinca minor, Periwinkle

The situation of environmental decline induced by invasive alien species will not improve without public recognition of the problem. Combined efforts of public and private groups to combat the existing invasions and prevent new problems will be needed to preserve our regions' biodiversity and natural communities.

We at the North Carolina Wild Flower Preservation Society strongly urge you not to propagate or plant species that you suspect may pose an invasive threat to the environment. If you are unsure of a plants tendency or suspect an invasive plant is being distributed or sold, please call the North Carolina Botanical Garden (919) 962-0522 for advice.



Section 7: Native Plant Gardens to Visit

Asheboro

North Carolina Zoological Park
4401 Zoo Parkway
Asheboro, NC 27203
336-879-7000

Asheville

The North Carolina Arboretum
100 Fredrick Law Olmstead Way
Asheville, NC 28806
828-665-2492

UNC-Asheville Botanical Garden
151 W.T. Weaver Blvd
Asheville, NC 28804
828-252-5190

The Biltmore Estate
One North Pack Square
Asheville, NC 28801
828-274-6333

Bath

John Lawson Memorial Garden
Ruth McCloud Smith Memorial Garden
Bonner House
207 Carteret St.
Bath, NC 27808
252-923-3971

Beaufort

Joseph Bell House
Josiah Bell House
Apothecary Shop, restored housed gardens
Turner St.

Boone

Daniel Boone Native Gardens
Horn in the West Dr.
Boone, NC 28607
828-264-6390

Cary

Hemlock Bluff Natural Area
2616 Kildare Farm Road
Cary, NC 27511
919-387-5980

Chapel Hill

The North Carolina Botanical Garden
CB 3375, Totten Center, UNC-CH
Chapel Hill, NC 27599-3375
919-962-0522

Charlotte

RibbonWalk, Charlotte's Botanical Forest
4700 Hoyt Hinson Rd.
Charlotte, NC 28223
704-372-9594

UNC-Charlotte Gardens
HWY 49
Charlotte, NC 28223
704-331-0664

Wing Haven Gardens and
Bird Sanctuary
248 Ridgewood Ave
Charlotte, NC 28209
704-331-0664

Clemmons

Tanglewood Arboretum and
Rose Garden
HWY 158
Clemmons, NC 27012
336-778-6330

Clyde

The Campus Arboretum of
Haywood Community College
185 Feedlander Dr.
Clyde, NC 28721
828-627-4640

Davidson

Davidson College Arboretum
Davidson College
Davidson, NC
704-892-2119

Durham

Sara P. Duke Gardens
Duke University
Durham, NC 27706
919-684-3698

Greensboro

Bicentennial Garden
Greensboro Arboretum
The Bog Garden
Greensboro, NC 27402
336-373-2199

Louisburg

DeHart Botanical Gardens, Inc
3585 US 401 South
Louisburg, NC 27549
919-496-4771

Manteo

The Elizabethan Gardens
1411 HWY 64
Manteo, NC 27954
252-473-3234

New Bern

Tryon Plalace Gardens
Box 1007, 610 Pollock St
New Bern, NC 28560
252-638-5109

Pinehurst

Sandhills Horticultural Gardens
Sandhills Community Gardens
2200 Airport Rd.
Pinehurst, NC 28374
910-692-6185

Pittsboro

White Pines Natural Area
Triangle Land Conservancy
P.O.Box 1301
Research Triangle Park, NC 27709
919-833-3662

Raleigh

The JC Raulston Arboretum
Department of Horticultural Science
NCSU, Box 7609
Beryl Rd.
Raleigh, NC 27695
919-515-3132

Raleigh Rose Garden
Hemerocallis Society Display Garden
Raleigh Parks and Recreation Office
241 Wade Ave.
Raleigh, NC 27607
919-831-6640

Mordecai House and Gardens
1 Mimosa St.
Raleigh, NC 27604
919-834-4844

Red Springs

Flora Macdonald Azalea Gardens
Flora Macdonald College
Red Springs, NC
910-843-4995

Reidsville

Chinqua-Penn Plantation
Rt. 3 Box 682
Reidsville, NC 27320
336-349-4576

Salisbury

Hurley Park
P.O. Box 479
Salisbury, NC 28145
704-638-5500

Poets and Dreamers Garden
Livingston College
Salisbury, NC 28145
704-638-5500

Wake Forest

Rock Cliff Farm
B.W.Wells Association, Inc.
6015 Jeffreys School Rd
Raleigh, NC 27612

Wilmington

Hew Hanover County Extension Arboretum
and Airlie Gardens
6206 Oleander Dr.
Wilmington, NC 28403
919-763-9871

Greenfield Gardens
City of Wilmington
Box 810
Wilmington, NC 28401
919-763-9871

Wilkesboro

Wilkes Community College Gardens
P.O. Box 120
Wilkes Community College
Wilkesboro, NC 28697
336-838-6141

Winnabow

Orton Plantation gardens
RFD 1
Winnabow, NC 28479
910-371-6851

Winston-Salem

Reynolda Gardens of Wake Forest University
100 Reynolda Village
Winston-Salem, NC, 27106
336-585-0255



Section 8: Recommended Literature Guide

The following guides to identification, cultivation and propagation of native plants are those most often used by members of the N.C. Wild Flower Preservation Society. Before purchasing personal copies, references should be reviewed in local public, university, or botanic garden libraries to find which best suit your gardening needs. Other references found particularly helpful should be brought to the attention of the editors.

Campbell, C. C., W. F. Hutson, H. L. Macon and A. J. Sharp. 1964. *Great Smoky Mountains Wildflowers*. Univ. Tenn. Press, Knoxville, Tenn. 88 pp.
(popular paperback with 127 colored photos and short notes)

Dormon, Caroline, 1958. *Flowers Native To The Deep South*. McFarland Co., Harrisburg, Pa. 176 pp. (line drawings, some color plates, descriptions, culture methods)

Duncan, Wilbur H. and Leonard E. Foote. 1975. *Wildflowers Of The Southeastern United States*. Univ. of Georgia Press, Athens, Ga. 296 pp. (colored photos, descriptive notes on identification, photographing, conservation)

Foster, Gordon. 1971. *Ferns To Know And Grow*. Hawthorn Books, Inc., N.Y. 258 pp.
(b & w photos, line drawings, native and exotic fern descriptions, ranges, cultivation, propagation)

Greene, Wilhelmina F. and Hugo L. Blomquist. 1953. *Flowers Of The South: Native And Exotic*. Univ. of N:C. Press, Chapel Hill, N.C. 208 pp. (line drawings and color paintings, descriptions, habitats, ranges)

Justice, William S. and C. Ritchie Bell. 1968. *Wild Flowers Of North Carolina And Surrounding Areas*. Univ. of N.C. Press, Chapel Hill, N.C. 217 pp.

(400 color photos, notes on characteristics, habitat, index number for each species in the *Manual Of The Vascular Flora Of The Carolinas*)

Lawrence, Elizabeth. 1967. *A Southern Garden: A Handbook For The Middle South*. Univ. of N.C. Press, Chapel Hill, N.C. 261 pp. (descriptions, list of information on blooming season, general information on gardening with cultivated plants)

Phillips, Harry R. 1985. *Growing and Propagating Wild Flowers*. University of N.C. Press, Chapel Hill, NC, 325 pp. (line drawings, description of cultivation, propagation and seed collection of nearly 100 genera of native plants)

Radford, A. E., H. E. Ables, and C. Ritchie Bell. 1968. *Manual Of The Vascular Flor Of The Carolinas*. Univ. of N.C. Press, Chapel Hill, N.C. 1183 pp. (line drawings, technical keys, descriptions, distribution maps)

Schnell, Donald. 1976. *Carnivorous Plants Of The United States And Canada*. John F. Blair, Publishers, Winston-Salem, N.C. 125 pp. (color photos, line drawings, discussion of each genera, with map of range, complete description, general discussion of each, detailed instructions on cultivation, propagation and bog creation)

Steffek, Edwin F. 1973. *Wildflowers And How To Grow Them*. Crown Publishers, N.Y. (bl & w photos, color drawings, principles of identification, transplanting, propagation, conservation)

Wells, B. W. 1967. *The Natural Gardens of North Carolina*. Univ. of N.C. Press, Chapel Hill, N.C. 480 pp. (bl & w photos, general description of vegetation types, keys and description of plants by flower color, emphasis on understanding relation of plant to its habitat, orig. pub. 1933)

Glossary

- Annual - A plant that completes its life cycle in one season.
- Biennial - A plant that takes two years to complete its life cycle.
- Bulb - A short underground stem surrounded by leaves or scales.
- Cambium - The green living conductive tissue in a woody stem.
- Deadhead - To remove wilted blossoms after flowering.
- Dehise - To split apart and release mature seeds.
- Dioecious - A species of plant that has male and female flowers on separate plants.
- Fruit - The mature ovary of a plant that contains the seeds.
- Germinate - To start visible growth, to sprout.
- Herbaceous - Having little or no woody tissue.
- Inflorescence - The part of the plant the holds the flowers.
- Invasive - A plant that
- Loam - A rich native soil, high in fertility and with a fine texture.
- Monecious - A species of plant that had male and female flower on one plant.
- Perennial - A plant that lives for many years.
- Petiole - The short stem-like stalk of a leaf.
- Pistilate - Female flower parts or flowers with only female parts.
- Pollination - The transfer of pollen from the male to female parts of a flower.
- Rhizome - A horizontal underground stem that often roots and produces shoots at nodes.
- Scarified - Scratching or scraping a seed coat to promote water entry and germination.
- Stratified - Cold/moist treatments that break seed dormancy.
- Staminate - Male flower parts or flowers that have only male parts.
- Stolons - Underground horizontal roots.
- Sucker - The shoots from roots or lower parts of a plant.
- Tuber - A fleshy underground stem or rhizome.

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