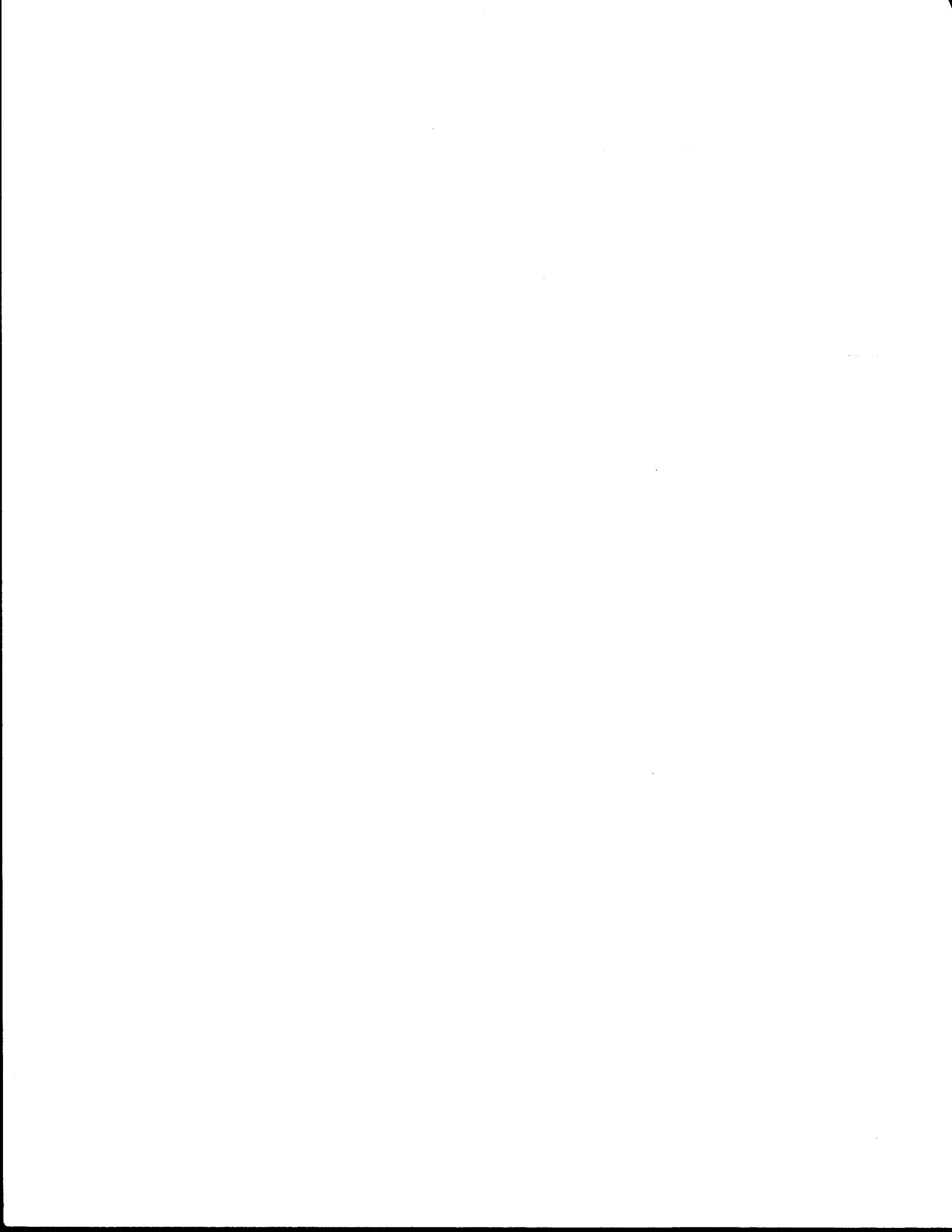


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PROPAGATION OF SOME NATIVE WOODY LANDSCAPING PLANTS

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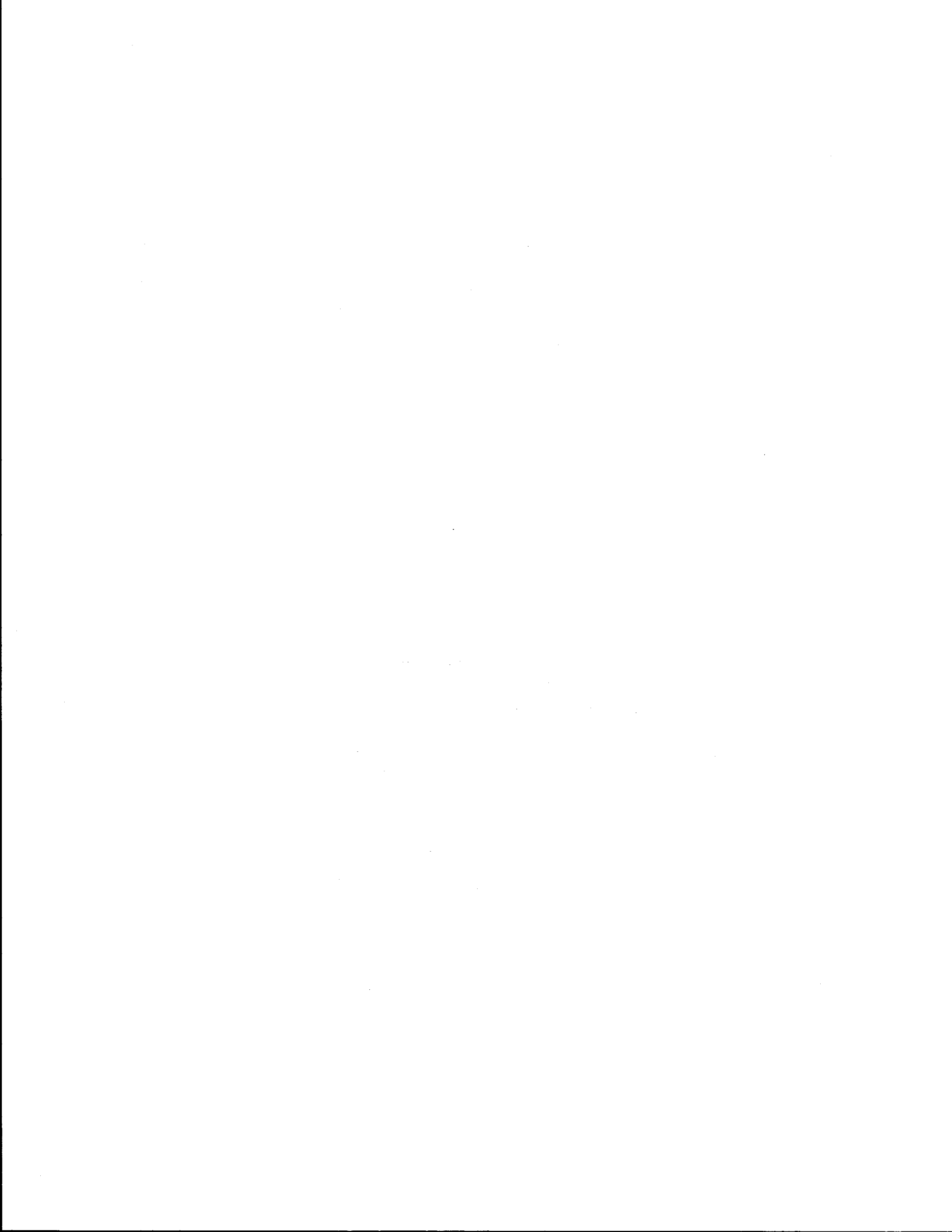
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* * * * *

Key Words: Dormancy, stratification, sand sagebrush, mountain mahogany, little walnut, black walnut, bur oak, Eve's necklace, viburnum, propagation, germination, roadside vegetation management, native plants.

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Trade names of materials are used for convenience only, and do not constitute an endorsement of these materials by SDHPT or TTI nor recommendations over comparable products not named.

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The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State Department of Highways and Public Transportation. This report does not constitute a standard, specification or regulation.

SUMMARY

Seven species of woody plants for which seed could be located were subjected to propagation tests. Results from these tests show that seed of these wild plants exhibit varying degrees of dormancy, but technology exists to propagate bur oak and two species of walnut. Bur oak and little walnut presently are in production by the Texas Forest Service (TFS) in Lubbock. Local ecotypes are collected, and 1-0 bareroot seedlings can be secured from TFS by ordering them early in the season.

Experience, particularly in the forest industry, suggests that propagation of these wild plants is best accomplished using 1-0 bareroot or containerized seedlings rather than direct seeding. Several investigators stressed the use of transplants over seeding on sites which are suboptimal, and many roadsides fall into this category.

Dormancy is nearly always a characteristic of seed from wild plants. Some seeds are dormant for only a short time; others such as viburnum have a complicated dormancy which may require several treatments, either concurrent or sequential, to overcome.

Germination, seedling vigor and rate of seedling growth are conditioned by the genetic background of the parent plant, growth condition at the time of seed development and conditions affecting germination and seedling growth. Even the limited performance recorded in these tests shows the variation which could be used as a basis for selection of superior plants. Growth and development for seedlings of mountain mahogany varied considerably. Seedlings of sand sagebrush grow slowly, at least initially.

The seven species examined for this report grow slowly enough from seed that they can best be propagated as seedlings for outplanting. Plant materials such as little walnut and bur oak should be purchased from the production unit of TFS or commercial sources.

IMPLEMENTATION STATEMENT

This is a report of research progress on plant propagation which has not progressed to the point of implementation. However, two of the materials selected for study are available from another agency, and should be secured there for outplanting.

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INTRODUCTION

Studies involving propagation of native woody plants were initiated in 1985-86 in cooperative research with the Texas State Department of Highways and Public Transportation (SDHPT). These studies represent an added dimension by SDHPT to accelerate and accomodate the use of native plants on roadsides.

Landscape Architects and Vegetation Managers have an option of utilizing seeds, bareroot transplants or containerized plants for outplanting. Seed quality is difficult to determine, many seeds are dormant over varying periods of time, and initial growth above-ground often is slow for the first year.

Many of the seeds are destroyed by insects or rodents. Also most specifications call for planting multiple seeds at a seedspot, necessitating thinning if more than one seedling emerges. Dessication reduces the viability of acorns (Morgan and McWilliams 1981; Olson 1974), walnuts (Brinkman 1974), mountain mahogany (Deitschman et al. 1974) and other seeds.

Foresters began planting containerized tree seedlings in preference to direct seeding or bareroot transplants during the 1960's. Use of genetically improved planting material, production of even-aged quality stock, mechanization of planting and a more intensive plantation maintenance program hastened containerization (Hahn 1981). This led to the development of a number of container systems formed from paper, moss-vermiculite, biodegradable plastic and several other materials (Barnett 1981). Some trees still are planted as bareroot seedlings, especially in smaller programs.

Thirteen species of plants native to the area were outplanted as year-old containerized transplants along a mountain road near Reno, Nevada. Survival on opposing north- and south-facing 2:1 slopes ranged from 75% to 93% over three years (Everett 1980). Direct seeding of various oaks in the South gave approximately 50% seedling stands (Johnson 1981; Johnson and Krinard 1985).

EXPERIMENTAL PROCEDURES

The objective of this study was to determine if certain woody plants should be propagated in place from seed or as a seedling transplant approximately one year of age.

Ten species of native trees and shrubs which grow naturally in Central Texas were selected for study:

Scientific Name	Common Name
<u>Artemisia filifolia</u> Torr.	Sand sagebrush
<u>Cercocarpus montanus</u> Raf.	Mountain mahogany
<u>Juglans microcarpa</u> Berl.	Little walnut
<u>Juglans nigra</u> L.	Black walnut
<u>Morus microphylla</u> Buckl.	Mountain mulberry
<u>Prunus mexicana</u> Wats.	Mexican plum
<u>Quercus macrocarpa</u> Michx.	Bur oak
<u>Rhus microphylla</u>	Littleleaf sumac
<u>Sophora affinis</u> Torr. & Gray	Eve's necklace
<u>Viburnum rufidulum</u> Raf.	Rusty blackhaw

Species for which at least limited amounts of seed could be found included sand sagebrush, mountain mahogany, black walnut, little walnut, bur oak, Eve's necklace and rusty blackhaw.

Seed were assembled from commercial sources, from other State agencies or by collection. Propagation of these plants from seed were scheduled at Vernon and at College Station.

Propagation studies involved standard laboratory germination tests together with plantings in a greenhouse or a nursery at Vernon or College Station. If transplants are indicated for outplanting, then younger plants are preferred over older stock because:

1. They are considerably less expensive.
2. They are easier to outplant and suffer less transplant shock than older plants.
3. Production can relate more readily to demand.

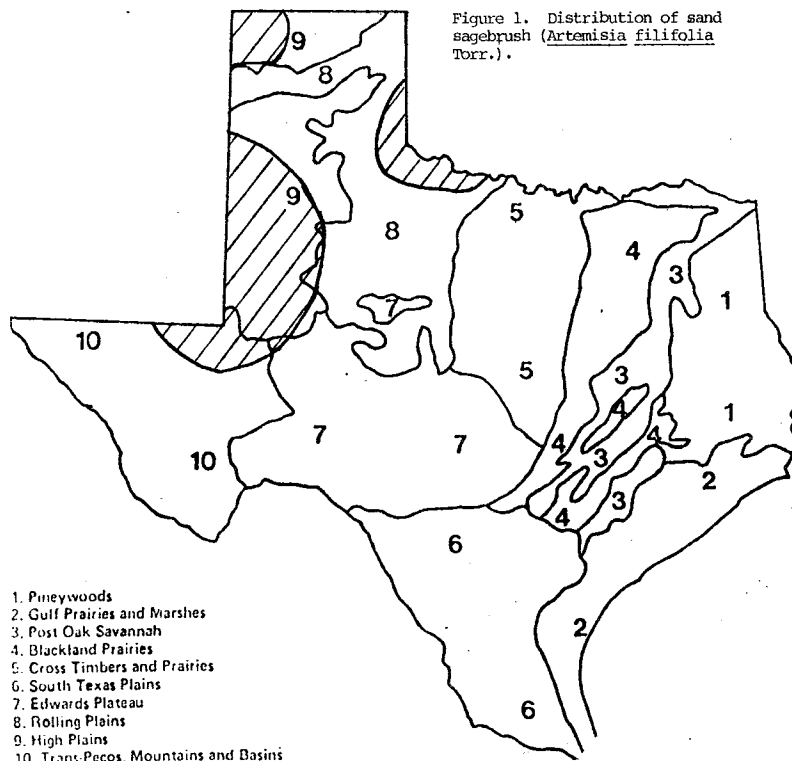
RESULTS AND DISCUSSION

Important landscaping features and propagation profiles are presented by plant species individually.

1. Sand sagebrush (Artemisia filifolia Torr.) is a grayish aromatic shrub, up to 4 ft. tall. Flowers are inconspicuous and are borne in dense leafy panicles. Leaves are filiform (Cornell and Johnston 1970; Vines 1960).

This plant is locally abundant in areas of deep loose sand along the Red River, in the western Panhandle and in the Trans Pecos (Fig. 1). Along with other plants it is a host for Orobanche multiflora Nutt. and O. ludoviciana Nutt. (Cornell and Johnston 1970).

Propagation studies. Specific germination reports were not found for this sagebrush species, but several other species of sagebrush germinate readily at relatively cool temperatures. Exposure to light may enhance germination. Plants may be outplanted as 1- or 2-year old seedlings (Deitschman 1974).



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Seed of this species were collected at several locations in northwestern Texas, cleaned and stored dry at 20°C. Viability was checked by planting on damp peat moss at room temperature (approximately 20°C). When those seeds sprouted additional seeds were planted on the surface of peat moss in a greenhouse and the tray covered with plastic sheeting. The plastic sheeting was removed when seeds began to germinate. Seedling development is very slow.

Seedlings average 7.2 cm in height after 5 months and will remain in the greenhouse until they are large enough to transplant.

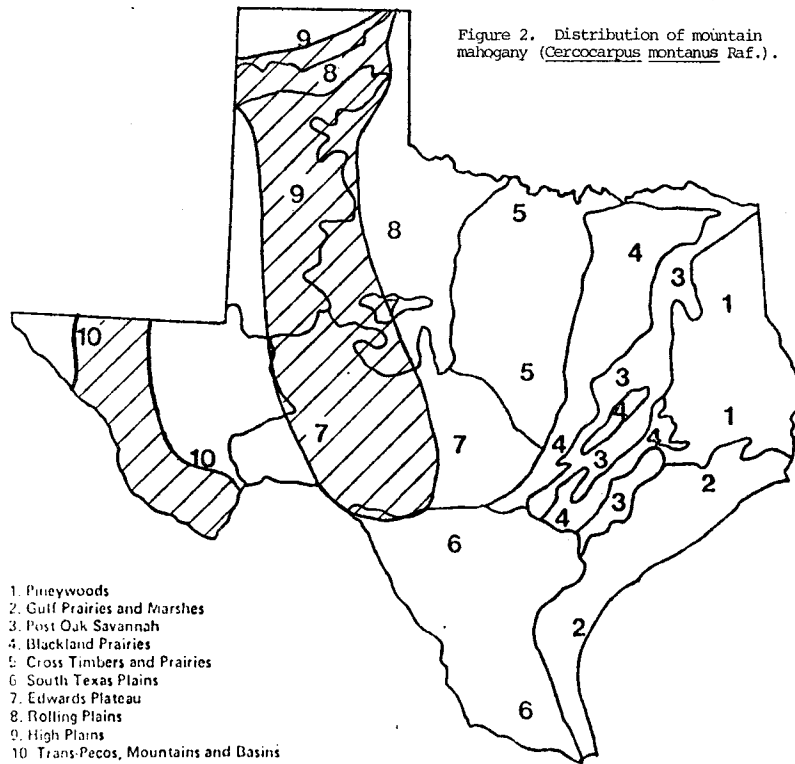
Detailed germination studies are underway.

2. Mountain mahogany (*Cercocarpus montanus* Raf.) is an evergreen or semi-evergreen bushy shrub, rarely a small tree. The leaves are simple, alternate and often fascicled on short spurlike branches. The leaves are toothed, gray to gray-green with prominent veins.

Flowers are solitary or in fascicles of 2-3, crowded on short spurlike branches into groups of 5-15 flowers.

The distinctive fruit is a hairy achene about 1/2 inch long with a silky-plumose tail (style remnant) approximately 3 1/2 inches long (Correl and Johnston 1970; Vines 1960).

The Texas form is a local variant var. argenteus and occurs in canyons and breaks of the Panhandle and Edwards Plateau (Fig. 2) most commonly on north-facing slopes. It withstands grazing well, so probably could be sheared (U.S. Forest Service 1937).



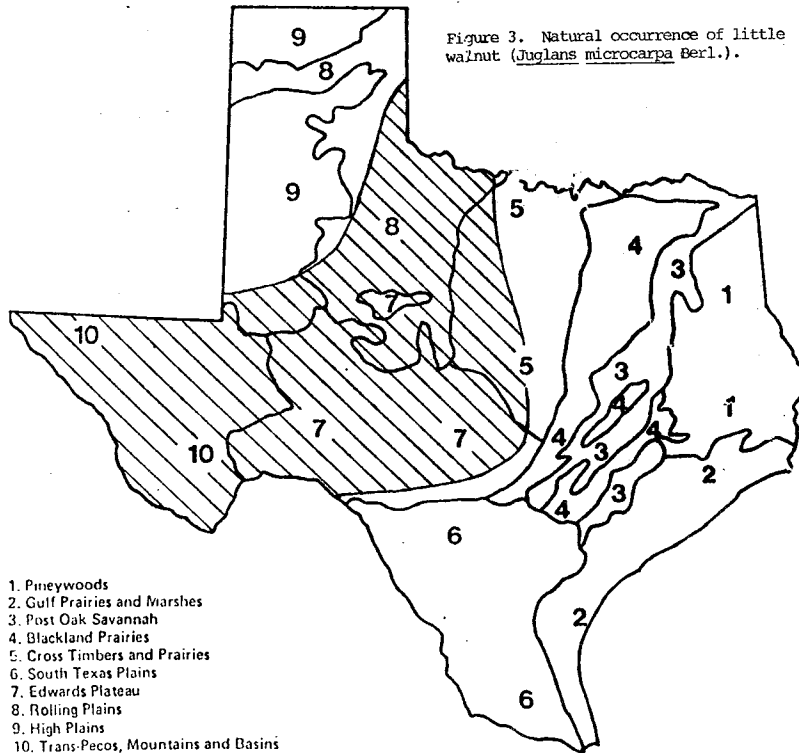
NATURAL VEGETATIONAL AREAS OF TEXAS

Propagation studies. Ripe fruit is collected in late summer or early fall and the feathery styles removed for planting. Seed dormancy is extremely variable, but cool moist stratification often aids in overcoming dormancy. Field plantings must be kept moist until germination is complete (Deitschman et al. 1974; Wasser 1982).

Seeds were collected in December 1984 and November 1985 from plants growing on a canyon wall near Junction, TX. The seeds were rubbed to remove the feathery style, and stored dry at 20°C. Ten months after collection seeds were set to germinate at 10° and 20°C. After 14 days the seeds at 20°C germinated 49% in 14 days, but the seeds at 10°C failed to grow. At this time they were moved to 20°C and germinated 78% in 14 days. These seedlings were transplanted to a styrofoam block planter and later to a nursery row. After 5 months seedling height ranged from 2.5 to 14.0 cm and averaged 6.75 cm.

Seed collected in 1985 germinated 25% two months after collection at 20°C. Tests will continue to establish germination and seedling profiles.

3. Little walnut (Juglans microcarpa Bevl.) usually grows as a many-stemmed shrub or small tree with a rounded canopy. It is found growing in rocky streambeds and bottomlands westward from the Colorado River through the Edwards Plateau into northern Mexico, southeastern New Mexico and western Oklahoma (Fig. 3). The leaves are deciduous, compound and alternate. The fruits are spherical, approximately 2 cm in diameter, becoming brownish when ripe. The enclosed nut has a thick hard shell and contains an edible kernel (Brinkman 1974; Correll and Johnston 1970; Vines 1960).



1. Pineywoods
2. Gulf Prairies and Marshes
3. Post Oak Savannah
4. Blackland Prairies
5. Cross Timbers and Prairies
6. South Texas Plains
7. Edwards Plateau
8. Rolling Plains
9. High Plains
10. Trans-Pecos, Mountains and Basins

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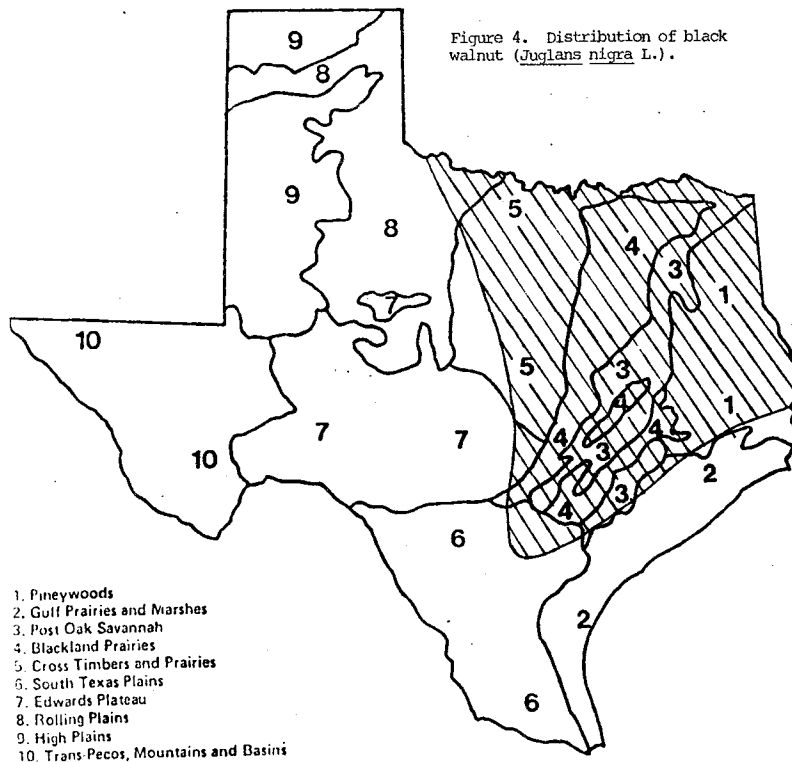
Propagation studies. Fruits are collected during fall and early winter, either after they have fallen or been harvested from the trees. Nuts are extracted from the husk by runing the fruits through a corn sheller. Un-filled seeds can be separated by floating on water.

Hulled, unstratified nuts may be planted in the fall, or stratified in moist sand or peat at 1° to 10°C for 60 to 120 days for spring planting. About 15 nuts are planted per linear foot of row and a suitable mulch installed. Seedlings grow rapidly and quickly develop a deep taproot. Rootpruning at a depth of 8-10 inches aids in the development of a good root system (Brinkman 1974).

In 1985, stratified nuts obtained from Texas Forest Service (TFS) in Lubbock were seeded directly in a nursery row. Emergence was less than 5%, which paralleled the experience of TFS. Nuts still in cold storage in late summer appeared sound when cracked. Nuts set to germinate in damp peat moss at 20°C failed to produce seedlings also, so the procedure to break dormancy was not determined.

4. Black walnut (Juglans nigra L.) grows to be a handsome tree on deep fertile soils, but it grows more slowly on dry sandy ridges, slopes and wet bottomlands. The canopy is large and rounded, and foliage is deciduous. The bark is very rough, and varies in color from black to reddish. The fruit is an individual nut enclosed in a leathery husk about 5 cm diameter, solitary or in clusters (Correll and Johnston 1970; Sperry 1982; Vines 1960; Wasser 1982).

Texas is the southwestern fringe of the natural distribution of black walnut (Fig. 4), and it will grow on moister sites westward to the 25-inch mean precipitation line. It is not found naturally on the Coastal Prairie (Wasser 1982).



NATURAL VEGETATIONAL AREAS OF TEXAS

Propagation Studies. Fruits are collected during fall and early winter, either after they have fallen or been harvested from the trees. Nuts are extracted from the husk by running the fruits through a corn sheller. Unfilled seeds can be separated by floating them on water.

Hulled nuts should be placed in moist stratification for at least 60 days at 1° to 10°C. Stratified nuts can be direct seeded, 3 nuts at a seedspot, but survival usually is better if container stock is planted (Wasser 1982).

Stratified nuts were obtained from the Texas Forest Service (TFS) at Alto, Texas. These were planted at Vernon and irrigated using a drip system. Emergence was less than 5%, seedling development was slow, and seedlings were discarded at the end of the growing season.

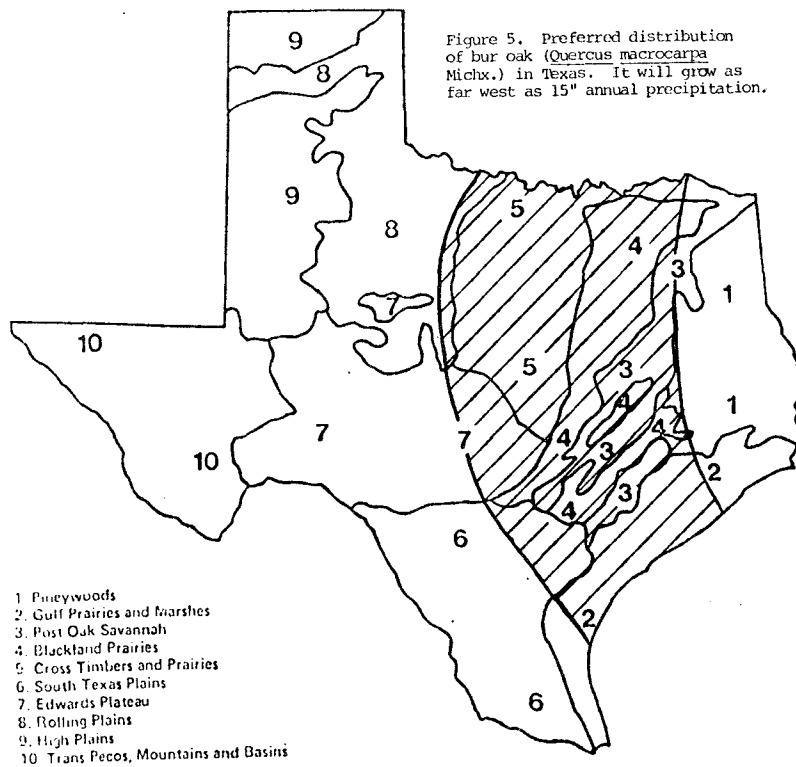
5. Bur oak (Quercus macrocarpa Michx.) grows to be a large tree with a rounded canopy of dark green, deciduous leaves. The bark is rough, and ranges in color from light gray to reddish brown. Bur oak produces one of the largest acorns, and the acorns are borne solitary or in pairs in a fringed cup that encloses more than one-half of the nut.

Bur oak is moderately fast-growing (Wasowski and Ryan 1985; Wasser 1982). It grows in a very wide range of soils from sands to clays (Thornburg 1982) and tolerates a variety of chemical and physical soil properties from acid (pH 4.0) to moderately basic soils. Drought tolerant, it grows in as little as 15 inches average precipitation and thrives at 30-40 inches (Wasser 1982) (Fig. 5).

Propagation studies. Bur oak is highly variable in growth habit so local materials should be used (Thornburg 1982). Acorns should be collected when they start to drop from the tree and put immediately into moist stratification. Acorns allowed to dry suffer a rapid decline in germinative capacity. Stratification for 60 days at 5°-8°C speeds germination (Olson 1974; Vines 1960; Wasser 1982). Stratified acorns can be direct seeded, 3 acorns to a seedspot, but 1-0 or 2-0 nursery stock may be outplanted in early spring (Wasser 1982).

Stratified acorns from near Christoval, Lubbock and Menard were secured from TFS in Lubbock, TX. These were seeded directly into nursery beds in a randomized block design having 3 replications at Vernon. Emergence averaged 60% with no significant differences among seed sources. Germination was 25% in pots at College Station.

Nursery plants at Vernon were root-pruned in November and lifted in January 1986 for outplanting in a roadside park near Weinert. Seedlings classed 1-0 represented 26% of planted acorns compared with 50% produced by TFS. TFS does not carry over seedlings into the second year. Significantly greater seedling survival was noted following inoculation with mycorrhizae in pot culture at College Station, and plants from pot culture were outplanted in the Lufkin District.



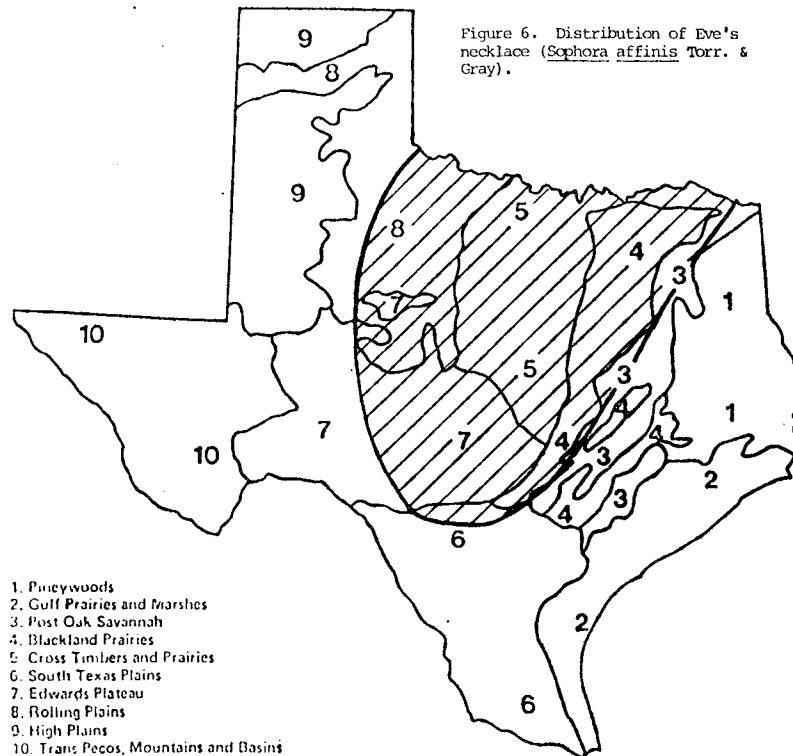
NATURAL VEGETATIONAL AREAS OF TEXAS

6. Eve's Necklace (*Sophora affinis* Torr. & Gray) is a leguminous shrub or small tree with dark green compound leaves. It thrives on limestone soils (Fig. 6) in full to partial sunlight, and grows to be a small tree in full sun (Vines 1960, Wasowski and Ryan 1985). It is considered extremely drought tolerant (Wasowski & Ryan 1985). The bark forms thin oblong scales and ranges in color from gray to reddish brown (Vines 1960). The axillary flower clusters (racemes) resemble pink wisteria (Wasowski & Ryan 1985). The brown seeds are contained in black pods (when ripe) constricted between each seed to resemble a string of beads.

Intolerant of shade, it is often found in small groves on hillsides or along streams (Vines 1960). The sparse foliage produces light shade (Wasowski and Ryan 1985).

Propagation studies. Seeds should be extracted from the pods and scarified with concentrated sulfuric acid. Harvesting the pods before the seed coats become hard facilitates germination as in *Sophora secundiflora*.

Seeds secured from a commercial source germinated less than 10 percent at Vernon and approximately 20 percent at College Station. Approximately 40 containerized plants were moved from College Station to Lufkin for outplanting.



NATURAL VEGETATIONAL AREAS OF TEXAS

7. Rusty blackhaw (*Viburnum rufidulum* Raf.) is known locally as downy viburnum, southern blackhaw or rusty nannyberry (Gould 1969). This species grows up to 40 ft. as a shrub or tree (Correll and Johnston 1970; Vines 1960; Wasowski and Ryan 1985) (Fig. 7). The flowers, leaves and fruit make this species desirable for landscaping.

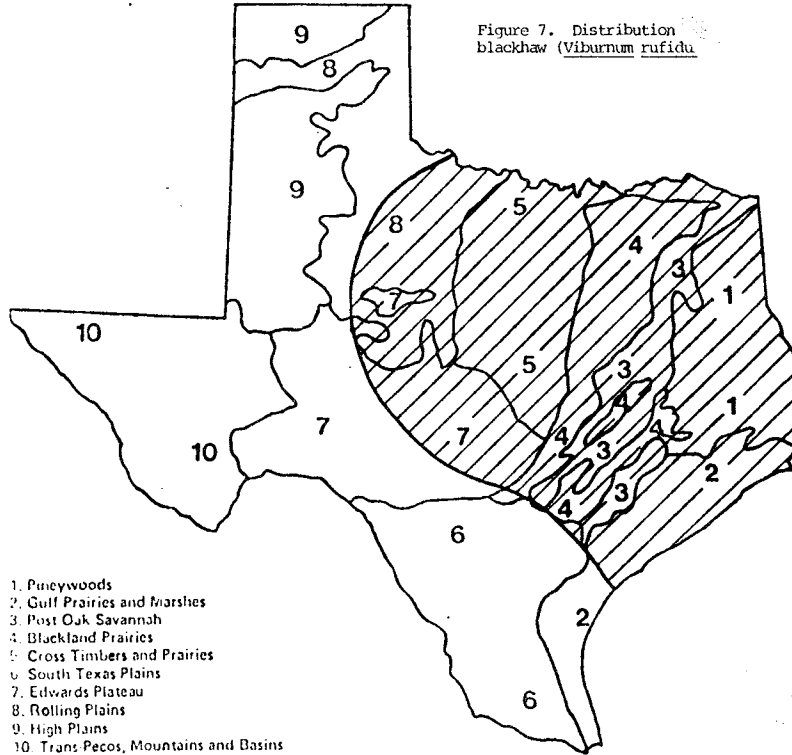
White flowers about 0.5 cm in diameter grow in flat clusters (cymes) 5-15 cm across. The fruit hangs in clusters of drupes 1.0 cm long, turning from pink to bluish-black and containing a single seed (Correll and Johnston 1970; Vines 1960; Wasowski and Ryan 1985).

Leaves are simple, opposite and deciduous, although they may be evergreen during mild winters in southern areas. They are orange-red initially, becoming shiny dark green above with dense, wooly hairs underneath (Correll and Johnston 1970; Vines 1960).

Propagation studies. Fruits are hand-picked when they become ripe and either dried or the seeds are extracted (Vines 1960). The harvested fruits should not be allowed to heat (Gill and Pogge 1974). Germination is slow and Vines (1960) suggests stratification for 6-12 months at 21°C, but Gill and Pogge (1974) suggest after-ripening until spring following collection for other southern species. Outplanting can be made using 1-0 or 2-0 stock (Gill and Pogge 1974).

A limited number of dried fruits were secured from a commercial source in 1985. Neither fruits nor extracted seeds showed significant germination at Vernon or College Station.

Rusty blackhaw is difficult to germinate because it has both a dormant and undeveloped embryo. Cleaned and dried seed do not germinate as well as uncleaned seed (Nokes 1986). The desirability of this species for landscaping suggests an in-depth study of its propagation.



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