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This gully was widening and deepening  
year by year, eating farther into  
good land

# TREES TO CONTROL SOIL EROSION ON IOWA FARMS

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IOWA STATE COLLEGE OF AGRICULTURE  
AND MECHANIC ARTS

EXTENSION SERVICE  
AMES, IOWA

Trees planted in the bottom and on the sides of the gully shown above  
stopped the erosion. In addition, a crop of trees is well  
along in development.



# Trees to Control Soil Erosion on Iowa Farms

By GUY R. RAMSEY

Soil erosion results from rapidly running water, usually called "run-off." Rapid runoff has the ability to carry heavy loads of silt and to scour away the soil. Fertile top soil is removed from fields resulting in impoverished land; deep gullies begin and eventually divide fields into smaller irregular areas where cultivation is difficult. With the formation of deep gullies, fields are drained of their sub-soil moisture; debris and silt flow out upon fertile lowlands destroying crops; streams are choked and floods result with their attending loss of life and property.

If water is permitted to run off slowly, however, or be absorbed by the soil, the problem of soil washing can be solved. If rainfall is intercepted or slowed up at points where it has the tendency to gather speed as runoff, or halted in its flow in gullies, soil washing can be prevented or controlled.

On cropped land trees do not serve as "cure alls" for soil erosion. Agronomic practices allied with mechanical methods may keep the land producing, but where costs run too high tree planting can be used as a means of saving the soil. Tree planting gives protection at critical points from extension of gullies back in fields. Other measures of soil erosion may augment or be augmented by tree plantings.

## Farm Practices Resulting In Erosion

Clearing steep timbered slopes.

Overgrazing—excessive removal of vegetative cover.

Cultivation of steep slopes, and other careless cultural practices.

Unwise location of drives and stock lanes.

## Two Kinds of Erosion

*Sheet Erosion.* Occurs uniformly, as a gradual removal of soil leaving a rather smooth (ungullied) slope. It may proceed unnoticed until it is recognized by spots of exposed subsoil on the slopes of fields.

*Gully Erosion.* This varies in size and depth from the early stages when the ditches are termed "fingers," to advanced stages when they are gullies sometimes many feet deep and possibly many miles long.

## How Trees Serve to Prevent or Control Erosion

*Crowns of the Trees.* A covering of vegetation over the soil is highly desirable to control erosion. Rain falling upon the leaves, twigs, branches and trunks of trees is halted in



Fig. 1. This gully formed after the slopes were cleared of timber. Excessive grazing has caused further washing. Notice how the gully is widening.

its downward plunge. It either runs down the twigs, branches and trunks or slowly drops off.

**Forest Soil.** The soil-cover beneath trees, known as forest litter, is composed of decaying leaves and twigs and is rather spongelike, capable of absorbing great quantities of water. When the litter is saturated fallen leaves and twigs act as small dams, holding back small pools of water.

**Tree Roots.** Roots of trees also aid by binding the soil together. The roots penetrating into the soil make it possible for water to percolate to lower depths where it is absorbed by the surrounding soil.

#### Effect of Forests on Stream Flow

Much of the water absorbed or held back by forest litter, or which penetrates along the tree roots to lower levels, comes out as springs farther down the slopes.

Water moving slowly from forest soil is not able to pick up soil in quantities sufficient to cause erosion. Forest streams are usually clear and cold. It is such streams that are the most dependable supply of water for farms, communities and factories. Cold clear water is the environment of game fish; they cannot live in warm, muddy water.

#### Where Trees Can Prevent or Control Erosion

Forestation or reforestation can be practiced on the following types of land as a means of erosion control:

Uncultivated lands, too rough, stony, or poor for either cultivation or pasture, should be left in timber or planted to trees to serve as a protective cover for the soil.

Steep lands cleared of timber.

Land being eroded as a result of grazing practices.

Sheet eroded areas.

*Submarginal Land.*

The United States Department of Agriculture defines submarginal land as "land so poorly adapted to farming, or so seriously deteriorated that nothing is in store for the inhabitants but extreme poverty and wretchedness." In Iowa extended areas of sub-



Fig. 2. This large, raw gully in Monroe County was widening at the expense of adjacent fields.

marginal land are not common, but many farms have certain portions which could be classified as submarginal from a standpoint of profitable agriculture. Most of this land will produce good crops of timber which will also serve to prevent erosion.

*Gullied Land.* A cover of trees will usually stop the widening of gullies, and trees can check the flow of water when planted in the bottom of gullies.

### What to Plant

The principal consideration in planting trees is the prevention of soil-washing by furnishing a vegetative cover for the soil and a deeply penetrating soil-holding root system. The use of trees for wood may be a secondary consideration. In fact, the use of trees which have no value for their wood content may be fully justified by virtue of their soil-conserving ability.

**Upland trees for hillsides:** Such species as will withstand dry conditions or poor soil.

**Lowland trees:** Many trees are capable of growing under well-drained but moist conditions. Others can thrive in the moist bed of small streams or with their roots in water of creeks or rivers.

The trees listed in the chart in table 1 are either native of Iowa or are capable of thrifty growth in the state.

### Sources of Planting Material

*Nursery Stock.* Some nurseries are equipped to furnish trees for reforestation and erosion control. The stock available from such sources is usually 1-year-old seedlings.

*Clarke-McNary Nursery.* The Federal Clarke-McNary Law of 1924 authorizes cooperation of the federal government with

the states to grow trees to distribute to farmers for forestry purposes. The Iowa nursery is located at Ames in connection with Iowa State College.

*Raising Seedlings upon the Farm.* In view of the fact that a considerable number of trees are required in erosion control the farmer can economically supply himself with trees by gathering seed of forest trees from nearby woods and raising the seedlings in a garden. Some seeds can be purchased at reasonable rates from dealers in seeds of forest trees. The chart in table 1 shows the method of propagation and the treatment of seed of the native trees and of others adapting themselves to Iowa conditions. Nearly every tree or shrub has value in erosion prevention and control.

### General Treatment of Seeds of Forest Trees

*Sowing at Maturity.* Such forest trees as the Aspens, River Birch, Elms, Silver Maple, all Poplars and Willows bear seeds the germinating ability of which lasts for only a short time. Such seeds should be gathered and planted when they ripen in the spring.

*Cold, Dry Storage.* When mature, some seeds (see table 1) need to be dried by exposure to air and sunlight, then transferred to bags to hang in a cold place where rodents cannot reach them throughout the winter, usually an outbuilding or unheated attic.

*Cold, Moist Storage.* Some seeds must be kept in cold, moisture storage over winter. The following method is sometimes called stratification. Moist sand is placed in a box to a depth of 1 inch and covered with a layer of seed 1 inch thick, and another 1 inch layer of sand followed by another



Fig. 3. The same gully as shown in fig. 2, 4 years later. Willows are in the moist bottom, locust occupy the steep dry slopes, and pines have been planted back from the lip of the gully.

of seed, until all the seeds are stored or the box filled. The box should be buried with the top level with the soil, in a well-drained spot, and covered well with leaves and soil. If rodents are apt to disturb the seed, precautions should be taken to exclude them or an occasional inspection made to see that the seeds are not being destroyed. Stratified seed should be planted just as early in the spring as possible.

### Special Treatment of Seeds of Forest Trees

The thickness of the coat of some seeds prevents satisfactory germination unless given special treatment.

*Maceration.* The process of reducing fleshy fruits to a soft mass in order to easily extract the seed is accomplished by soaking or tearing the tissue apart by mechanical means.

*Black Locust Seed.* Black Locust trees can be grown in 1 year upon the farm. The following are methods of preparing the seed for planting.

1. Scarifying consists of the mechanical process of beating or scouring. A simple method is that of shaking a few seeds by hand in a glass jar with the top closed. Twenty minutes of vigorous shaking lengthwise of the jar is necessary.

2. Hot water treatment. Heat water to boiling before putting in the seed, 1 pound of seed to 4 to 6 quarts of water. Dry the seed before sowing in order to handle them better, but do not let them dry too long.

*Basswood Seed.* Mix seed with leaf-mold (decaying forest litter) as it is sowed in seed-beds. Mulch beds heavily with leaf-mold. Germination will occur the second season after sowing.

*Cuttings and Wild Seedling Stock.* A few trees can be propagated from cuttings made from the latest grown wood, usually from the previous year's growth. Trees suitable for planting in the moist bottoms of gullies are usually propagated by cuttings. Wild seedlings can often be successfully transplanted but transplanting from deep woods to directly sunlighted places is not often successful.

*Willows and Cottonwoods.* (Poplar) Cuttings 18 to 24 inches long from new wood of strong-growing sprouts should be made with smooth clean cuts. Cuttings should be made from the tree types of willows. Cuttings from large cottonwood trees will have to be shorter, usually about 8 inches and should be planted in the garden for a season in order that they may become rooted before being planted in gullies. Willow cuttings should be packed in a cool, slightly moist place if they cannot be immediately planted. If cut in the fall they should be bundled in 25's or 100's, buried in moist sand with butts downward firmly pressed against the soil and covered to be adequately protected from frost and freezing, or they may be packed in damp moss over winter in a root cellar. Stand them on end with the ends covered.

## Planting the Trees

*Time of Planting.* Early spring is the best time to plant to take advantage of moist soil conditions. Late spring plantings may be partially successful, fall planting is attended with danger of frost-heaving, winter planting is difficult or impossible because of frozen soil, and summer plantings are failures.

### Methods of Planting on Sheet-Eroded Areas

*Direct Seeding.* This method is not very successful because a large amount of seed is destroyed by animals and birds and by adverse weather or soil conditions.

*Planting Seedlings.* The roots should reach deep enough to be thoroughly covered with moist soil. Usually the tree should be set as deep as in its nursery position. The roots should be placed in a natural position, not curled up or crowded together. Moist top soil should be well tamped against the roots. If a tree can be easily pulled out after planting, it is not correctly planted. It should be firm enough to resist pulling out. The stem should stand erect. If the ground slopes steeply a shelf-like niche should be made, heaping the soil on the lower side, and the tree set in the center of niche.

*Natural Seeding and Sprouting.* Natural regeneration of trees can be accomplished wherever mature, seed-producing trees stand on or adjacent to the area, and by sprouts from stumps of recently cut trees. In either case, natural regeneration from seed-trees or from stumps, the area must be fully protected from livestock to prevent the young trees from death or injury by browsing or trampling.



Fig. 5. White Pine planted on steep land to stop excessive sheet erosion. These trees are 13 years old. Tama County.

## Planting in Gullies

*Moist bed of gullies.* Cuttings of cottonwood and willow and seedlings of sycamore and birch are most advisable for this work.

1. Set the cutting in a hole made with a spade or sharpened stick. Avoid driving the cuttings in, as this breaks the bark away from the wood which may prevent rooting.

2. Place cuttings with most of their length buried. Only 3 or 4 inches of an 18 or 24-inch cutting need be left above ground. Press the soil firmly against the entire length of the cutting.

3. Cuttings should be planted 2 feet apart in broad V-shaped line across the moist portion of the gully every 6 or 8 feet, with the "V" pointed downstream. (Fig. 6.)

4. Seedlings should be planted in similar manner.

5. Check the planting the second year for failure and re-plant blank spaces.

*Slopes of Gullies.* Black locust and red cedar are best for the steep slopes of gullies.

*Borders of Streams.* Black ash, aspen, cottonwood, basswood, birch, boxelder, choke cherry, dogwood, American elm, rock elm, larch, black maple, silver maple, sumac, sycamore, and willows are best adapted for borders of gullies and streams. Do not make the plantings as continuations of the V-shaped lines but plant irregularly in order to avoid formation of lateral gullies.

*Planting back from gully lips.* Use seedlings of trees listed in chart in table 1, taking into consideration the soil and other site requirements of the different species. This type

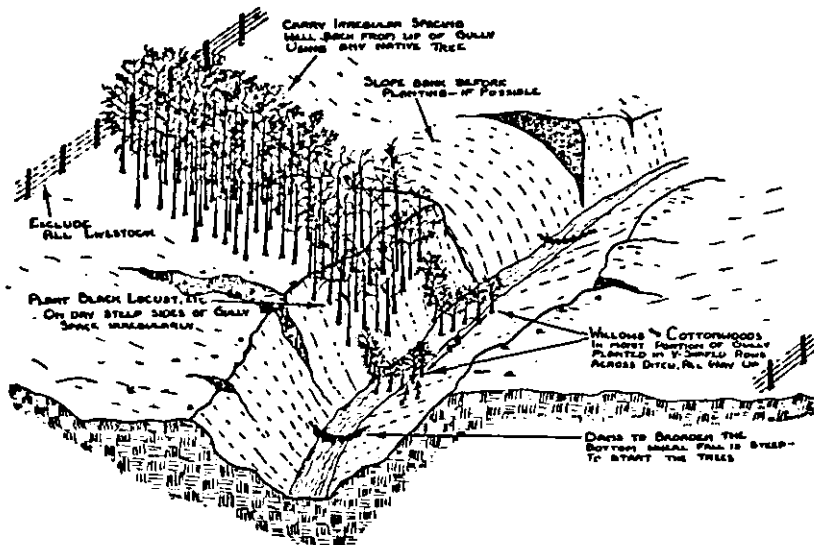


Fig. 6. Diagram showing method of planting a gully.



of planting should be carried back far enough to give ample protection and to prevent widening of the gully. The gully sides may be sloped off by plowing where such a process will aid in establishment of the vegetative cover.

If the resulting trees are to be cut for their wood when mature such species as will sprout from the stump should be placed at the most vital spots. Clear cutting should not be practiced, however, but a method of selective cutting should be followed in order to maintain a permanent compact forest cover and, in addition, to yield a continuous supply of material.

*Protection.* All tree plantings should be permanently and adequately fenced from intrusion of all livestock.

### Cover and Food For Wildlife

Tree plantings for erosion control lend themselves admirably to the requirements of game birds and wild animals. The large number of trees which can be made to serve as a vegetative cover for erosive soils enables a farmer to select for plantings many trees which will serve as cover or will produce food for game. In most cases the trees bearing fruit suitable for game are those best for cover.

Some shrubs particularly suitable for game food or cover may even occupy occasional spots throughout the forested area. Small thickets of wild berries, wild rose, hazelbrush, buck brush and button bush could occupy corners and borders of woodlands, and here and there open areas of blue grass maintained for game birds and animals.

The farmer should be able to sell hunting privileges on his farm or take game for his own table while maintaining protection for his erosive lands if an attractive environment for game is maintained.

### References

Care and Improvement of the Farm Woods, U. S. Dept. of Agri. Farmers' Bul. No. 1177.

Growing and Planting Hardwood Seedlings on the Farm. U. S. Dept. of Agri. Farmers' Bul. No. 1123.

Growing and Planting of Coniferous Trees on the Farm. U. S. Dept. of Agri. Farmers' Bul. No. 1453.

Woodlands for Iowa Farms. Extension Circular 222, Iowa State College.

Improving the Farm Environment for Wild Life. U. S. Dept. of Agri. Farmers' Bul. No. 1719.

**TABLE 1. CHART OF TREES SUITABLE FOR EROSION CONTROL IN IOWA**  
(See text for description of stratification, and special seed treatment.)

Tree Species	Seed Treatment	Plan- tation spacing ft.	Method of propa- gation	Commercial value of wood	Where most suitable for erosion contro.
Amelanchier (June Berry or Service Berry)	Macerate after fermentation & stratify	4	Seed-sprouts	None	Moist slopes, stream banks
Ash, Black	Sow at maturity or stratify	6	Seed	Furniture, varied uses	Stream banks, moist soil
Ash, Blue	Sow at maturity or stratify	6	Seed	Tool handles, furniture	Dry limestone soils
Ash, Green	Sow at maturity or stratify	6	Seed	Furniture	Moist or dry slopes
Ash, Mountain	Cold moist storage	6	Seed	None	Moist borders of streams
Ash, Prickly	Cold moist storage	4	Seed, suckers root cuttings	None	Sandy, gravelly slopes, stream banks
Ash, Wafer	Sow in fall	4	Seed	None	Rocky slopes. Border of wood.
Ash, White	Sow at maturity or stratify	6	Seed-sprout	Tool handles, varied uses	Moist slopes, bottomland
Aspen, Large- toothed	Plant when mature (spring)	10	Sprouts Cuttings Seeds	Crates, excel- sior, pulpwood	Moist or dry slopes
Aspen, Trembling (Quaking)	Plant when mature (Spring)	10	Cuttings, sprouts, seed	Small articles, pulp	Dry or moist slopes
Basswood, (Linden)	See page 6	6	Seed, sprouts layering	Cooperage, woodenware, boxes	Moist slopes
Birch, River	Sow at maturity	4	Seeds, sprouts	Furniture, woodenware	Moist bottoms of gullies, stream banks
Birch, White	Cold, dry Storage	4	Seeds, sprouts	Fuel, small articles	Moist and dry slopes
Bladdernut	Cold, moist Storage	6	Seed, suckers	None	Moist, woody slopes, borders
Box elder	Sow at maturity	6	Cuttings, seed, sprouts	Fuel	Moist slopes
Buckeye	Cold, moist storage	4	Seed, sprouts	Artificial limbs Woodenware	Moist slopes
Butternut	Stratify or fall planting	6	Seed	Cabinet-work	Low, rocky hill- sides
Catalpa, hardy	Cold, dry storage	6	Seed, sprouts	Posts	Moist or dry slopes
Cedar, Red	Remove pulp and stratify	6	Seed	Posts, timbers	Moist or dry slopes
Cedar, White	Cold, dry storage	6	Seed	Posts, poles, ties, shingles	Moist slopes, stream banks
Cherry, Choke	Macerate, stratify	6	Seed	None	Moist slopes, stream borders
Cherry, Pin	Macerate, stratify	6	Seed, sprouts	Little	Moist slopes, border of woods
Cherry, Wild Black	Macerate, stratify	6	Seed	Furniture	Moist or dry slopes, wood borders
Dogwood, Alternate-leaf	Stratify	2	Seed, germinat- ate 2nd yr. Cuttings	None	Moist, slopes stream borders, wood borders
Dogwood, Rough-leaf	Stratify	2	Seed, germinat- ate 2nd yr. Cuttings	None	Moist slopes, stream borders, wood borders
Elm, American	Sow at maturity (in spring)	6	Seed	Variety of uses	Dry or moist slopes, stream borders
Elm, Chinese	Purchase from dealers	4	Seed	Fuel (low)	Dry slopes
Elm, Cork or Rock	Sow at maturity	6	Seed	Variety of uses	Moist slopes, stream borders
Elm, Red or Slippery	Sow at maturity	6	Seed	Variety of uses	Moist or dry slopes

Tree Species	Seed Treatment	Plan- tation spacing ft.	Method of propa- gation	Commercial value of wood	Where most suitable for erosion control
Fir, Balsam	Dry, cold storage	8	Seed	Lumber	Moist slopes
Fir, Douglas	Dry, cold storage	8	Seed	Lumber	Moist or dry slopes
Hackberry	Remove coat stratify or fall plant	6	Seed, cuttings	Variety of uses	Dry rocky or gravelly slopes or moist
Hawthornes (several species)	Clean, scarify, cold, moist storage	6	Seeds	None	Dry or moist slopes, wood borders
Hickories (several species)	Cold moist storage	6	Nuts, sprouts	Variety of uses	Dry or moist slopes
Ironwood, Blue Beech	Sow at maturity	3	Seed, sprouts	Handles, levers	Dry slopes, gravelly or sha- dy moist slopes
Ironwood, Hop Hornbeam	Sow at maturity	4	Seed, sprouts	Fuel, levers handles	Dry or shady moist slopes
Juniper, dwarf	Remove pulp and stratify	6	Seed	None	Moist or dry slopes, rocky, gravelly
Kentucky Coffee Tree	Cold, dry storage and 4 hr. treat- ment with $H_2SO_4$ Conc.	8	Seed cuttings suckers	Furniture, posts poles, ties fuel	Moist slopes only
Larch	Cold, dry storage	8	Seed	Lumber, fuel	Moist slopes, stream borders
Locust, Black	See page 6	4 or 6	Seed, sprouts	Posts, poles	Dry slopes, steep gully sides
Locust, Honey	$H_2SO_4$ (Conc.) 2 hours	8	Seed, sprouts	Posts, ties	Dry or moist slopes
Maple, Black	Cold moist storage	6	Seed	Furniture, lumber	Moist clay slopes, dry rich slopes
Maple, Mountain	Cold moist storage	6	Seed, sprouts	None	Damp rocky slopes, wood borders
Maple, Silver (Soft)	Sow at maturity	6	Seed, sprouts	Fuel, cheap lumber	Dry or moist slopes, stream borders
Maple, Sugar (hard)	Cold moist storage	6	Seed	Furniture lumber	Moist clay slopes Dry rich slopes
Mulberry	Clean and store in cold, moist	6	Seed	Posts	Dry or moist slopes, borders
Oak, Black	Cold moist storage	6	Seed, sprouts	Cheap furniture fuel, lumber	Dry or moist slopes
Oak, Bur	Sow at maturity	6	Seed, sprouts	Furniture, lum- ber, ties, posts	Dry or moist slopes
Oak, Chestnut	Sow at maturity	6	Seed, sprouts	Furniture, lum- ber, ties, posts	Dry or moist slopes
Oak, Chinquapin	Sow at maturity	6	Seed, sprouts	Furniture, lumber	Dry or moist slopes
Oak, Hill's	Cold moist storage	6	Seed, sprouts	Posts, fuel	Dry or moist slopes
Oak, Jack	Cold moist storage	6	Seed, sprouts	Fuel	Dry or moist slopes
Oak, Laurel or Shingle	Cold moist storage	6	Seed, sprouts	Fuel	Stream margins moist slopes
Oak, Pin	Cold moist storage	6	Seed, sprouts	Furniture posts, fuel	Dry or moist slopes
Oak, Post	Sow at maturity	6	Seed, sprouts	Lumber	Dry, sandy, poor soils
Oak, Red	Cold moist storage	6	Seed, sprouts	Lumber, ties, posts	Dry or moist slopes
Oak, White	Sow at maturity	6	Seed, sprouts	Furniture, lum- ber, posts, ties	Dry slopes
Osage Orange (hedge)	Fruit decay, over winter outdoors. Extract seed	4 or 6	Seed, sprouts	Posts, poles	Dry or moist slopes, wood borders
Pawpaw	Cold, dry storage	4	Seed	None	Moist, shady slopes

Tree Species	Seed Treatment	Plan- tation spacing ft.	Method of propa- gation	Commercial value of wood	Where most suitable for erosion control
Persimmon	Cold moist storage	6	Seed, root cuttings or sprouts	Small articles	Dry or moist sandy slopes, wood borders
Pine, Austrian	Cold, dry storage	8	Seed	Lumber, fuel	Dry slopes
Pine, Jack	Cold, dry storage	8	Seed	Fuel, ties	Dry, sandy slopes or stream borders
Pine, Red	Cold, dry storage	8	Seed	Lumber, fuel	Dry or moist slopes
Pine, Scotch	Cold, dry storage	8	Seed	Lumber, fuel	Dry slopes
Pine, Western Yellow	Cold, dry storage	10	Seed	Lumber, fuel	Dry slopes
Pine, White	Cold, dry storage	8	Seed	Lumber, fuel	Moist slopes
Plum, Wild	Cold moist storage	2	Seed	None	Dry or moist slopes, wood borders
Poplars, Cotton-woods (several species)	See page 6	10	Cuttings, Transplant wild seedlings	Boxes, crates, pulp	Moist bottoms of gullies and streams
Prairie Crab Apple	Dry, moist or cold moist storage for short period	4	Seed, buddings grafting	None	Dry or moist slopes, wood borders
Red Bud	Cold, dry storage	3	Seeds	None	Moist slopes, borders of woods
Sassafras	Sow at maturity	6	Seed, sprouts	Cooperage	Dry or moist slopes
Spruce, Blue	Cold, dry storage	8	Seed	Lumber, fuel, Xmas trees	Dry or moist slopes
Spruce, Norway	Cold, dry storage	8	Seed	Lumber, fuel, Xmas trees	Dry or moist slopes
Spruce, White	Cold, dry storage	8	Seed	Lumber, fuel, Xmas trees	Dry or moist slopes
Sumac	H <sub>2</sub> SO <sub>4</sub> (Conc.) for 20 min. & then cold dry for month	4	Seed, root cuttings, sprouts	None	Steep dry gully sides, borders of woods
Sycamore	Cold moist storage	4 or 8	Seed	Cooperage, small articles	Moist stream bottoms
Wahoo	Stratify	3	Seed, Fall cuttings	None	Dry or moist slopes, wood borders
Walnut, Black	Stratify or fall plant	6	Seed	Furniture	Moist slopes, rich bottom land
Willow (several species)	Sow at maturity	2	Cuttings	Fuel	Moist gully or stream bottoms

Farmers are invited to avail themselves of the distribution of trees for forestry purposes from the State Forest Nursery. For information write to the Extension Forester, Iowa State College, Ames, Iowa.

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