An Evaluation of TREES and SHRUBS for Planting Surface-Mine Spoils

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TREES and SHRUBS
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ABSTRACT

Fifty-five tree and shrub species were evaluated on two surface-mine sites in eastern Kentucky. After 4 years' growth, comparison of survival and growth was used to identify the promising species for planting on acid surface-mine spoils. Three species of birch and three *Eleagnus* species survived and grew well on a range of sites. Noncommercial tree species and shrubs adapted to acid surface-mine spoils included silktree, tree-of-heaven, French tamarisk, Japanese fleeceflower, and Amur privet.

FIELD TRIALS HAVE suggested the suitability of many tree species for the reforestation of surface-mine spoils (*1, 2, 3, 4, 5, 6, 7*). Results from these trials have provided guidelines for selecting appropriate species for specific sites—usually tree species that would produce forest products with tangible commercial value. Species with little or no commercial value have seldom been included in these evaluations.

Today more emphasis is placed on site protection. There is a need for vegetation that will rapidly develop a protective cover as well as species that will provide long-term site protection. Trees and shrubs that will grow rapidly on a broad range of site conditions have become as important as species with commercial value.

In addition to site protection, more consideration is now being given to species that will enrich the soil and provide food and cover for wildlife. Soil enrichment is necessary for continued site protection, and wildlife plantings are becoming more important as pressures for recreation uses of the land increase.

Fifty-five tree and shrub species were evaluated in this study to determine their survival and growth on acid surface-mine spoils. These species provide one or more of the following benefits: potential economic value, wildlife food and cover, soil enrichment by nitrogen fixation, and aesthetic amelioration. Species showing rapid growth on a variety of site conditions are considered most attractive for surface-mine revegetation. The results of this evaluation help us to identify tree and shrub species that deserve expanded use on areas disturbed by surface-mining.

STUDY DESCRIPTION

A total of 28 tree species and 27 shrub species seldom planted on surface-mined sites were evaluated (tables 1 and 2). Planting stock was obtained from private, state, and federal nurseries. Selections from available stock were based on published and unpublished information from surface-mine-spoil plantings; literature on the geographic range of the plant; and references indicating the suitability of specific plants to acid and drastically disturbed sites. There was little informaion about some species, but interpretation of the available facts indicated possible survival on surface-mine spoils. For example, acid soils are required for the production of blueberries.

The study was established at two locations in Kentucky. Site 1 is located near London, Kentucky. Site 2 is located west of Middlesboro, Kentucky. The elevations at these sites are between 1,000 and 1,500 feet above sea level.

At each site, 12 blocks were planted to trees, and 12 blocks were planted to shrubs. Within each block, one species was randomly assigned to a 6-x-6-foot plot. Four seedlings spaced 3 x 3 feet apart were planted in each plot. Therefore, the evaluation of many species was based upon 96 seedlings planted in 24 plots at two sites. For some species, only a small number of seedlings were available. Seedlings for these species were planted on one site in as many blocks as possible. All stock was bare-rooted except rhododen-

Table 1.—Trees evaluated

Scientific name[1, 2]	Common name[3]
COMMERCIALLY IMPORTANT	
Abies fraseri Poir.	Fraser fir
Betula lenta L.	Sweet birch
Betula lutea Michx.	Yellow birch
Betula pendulata Roth.	European white birch
Thuja occidentalis L.	White cedar
Magnolia acuminata L.	Cucumbertree
Nyssa sylvatica Marsh.	Blackgum
Pinus nigra Arnold.	Austrian pine
Pinus thunbergi Parl.	Japanese black pine
Quercus coccinea Muenchh.	Scarlet oak
Quercus macrocarpa Michx.	Bur oak
Quercus palustris Muenchh.	Pin oak
Quercus serrata Thumb.	Sawtooth oak
Tilia cordata Mill.	Littleleaf linden
NONCOMMERCIAL OR ORNAMENTAL	
Acer negundo L.	Boxelder
Ailanthus altissima Swingle.	Tree-of-heaven
Albizzia julibrissin Burozz.	Silktree
Gleditsia triacanthos inermis Purch.	Thornless honeylocust
Morus alba tatarica Seringe.	Russian mulberry
Morus nigra L.	Black mulberry
Oxydendrun arboreum DC.	Sourwood
Sophora japonica L.	Japanese pagodatree
Ulmus pumila L.	Siberian elm
TALL SHRUB OR SMALL TREES	
Caragana arborescens Lam.	Siberian peashrub
Cornus florida L.	Flowering dogwood
Cotinus obovatus Raf.	American smoketree
Crataegus spp.	Hawthorn
Tamarix gallica L.	French tamarisk

[1] Little, Elbert L., Jr. Check list of native and naturalized trees of the United States. U.S. Dep. Agric. Handb. 41. 471 p. 1953.

[2] Fernald, Merritt L. Gray's manual of botany. Ed. 8, 1631 p. American Book Company. 1950.

[3] Kelsey, Harlan P., and William A. Dayton. Standardized plant names. 675 p. J. Horace McFarland Company. 1942.

Table 2.—Shrubs evaluated

Scientific name[1, 2]	Common name[3]
4 TO 6 METERS TALL	
Amorpha fruticosa L.	Indigobush
Cephalanthus occidentalis L.	Common buttonbush
Cotoneaster acutifolia Turez.	Peking cotoneaster
Elaeagnus angustifolia L.	Russian olive
Elaeagnus pungens Thumb.	Thorny olive
Elaeagnus umbellata Thumb.	Autumn olive
Ligustrum amurense Carr.	Amur privet
Ligustrum sinense Lour.	Chinese privet
Lonicera korolkowi zabeli Rehd.	Blueleaf honeysuckle
Syringa chinensis Willd.	Chinese lilac
Viburnum dentatum L.	Arrow-wood viburnum
1 TO 3 METERS TALL	
Berberis vulgaris L.	European barberry
Cornus amomum Mill.	Silky dogwood
Cytisus scoparius Lk.	Scotch broom
Elaeagnus multiflora Thumb.	Cherry olive
Hibiscus syriacus L.	Shrub-althea
Hydrangea quercifolia Bartr.	Oakleaf hydrangea
Lonicera tartarica L.	Tartarian honeysuckle
Polygonum cuspidatum Sieb. & Zucc.	Japanese fleeceflower
Prinsepia sinensis Oliver.	Cherry prinsepia
Rhododendron catawbiense Michx.	Catawba rhododendron
Symphoricarpus orbiculatus Moench.	Coralberry
Vaccinium spp.	Blueberry
TRAILING STEMS	
Rosa multiflora Thumb.	Multiflora rose
Rosa rugosa Thumb.	Rugosa rose
Rubus spp.	Dewberry
Rubus spp.	Blackberry

[1] Little, Elbert L., Jr. Check list of native and naturalized trees of the United States. U.S. Dep. Agric. Handb. 41. 471 p. 1953.

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dron, which was packed and planted with a small ball of nursery soil around the roots.

Plot size was designed to minimize spoil differences between planting holes and to simplify spoil-sampling procedures. After the seedlings were planted, a sample of surface spoil was collected from the center of each plot. Standard laboratory procedures were used to determine pH and total soluble salts. Available phosphorus was determined by the Bray No. 1 method.

At the end of the fourth growing season, species survival was determined, and the total height of each living plant was measured to the nearest tenth of a foot. Height measurements for all species represent the distance from the ground line to the tip of the longest branch when fully extended. This procedure was adopted because the growth forms of the species varied.

SPOIL CHARACTERISTICS AT PLANTING SITES

The spoils at Site 1 are predominantly gray and black shales, which had a pH of 4.5 or less at the time of establishment (table 3). Forty percent of all samples collected had a total soluble-salt concentration of 0.50 mmhos/cm or less (table 4). Available phosphorus was low to very low (less than 7 ppm) in about 60 percent of the samples (table 5). The spoil was less than a year old when planted. All blocks were established on relatively flat, graded portions of the disturbed area.

Table 3.—Distribution of spoils by pH classes, in percent

pH class	Shrub blocks Site 1	Shrub blocks Site 2	Tree blocks Site 1	Tree blocks Site 2
2.6 to 3.5	27.2	16.2	18.1	15.3
3.6 to 4.5	68.1	36.8	72.3	40.2
4.6 to 5.5	4.0	0.6	9.2	1.5
5.6 to 6.5	.7	2.8	.4	2.9
6.6 to 7.5	—	25.7	—	25.9
7.6 to 8.5	—	17.9	—	14.2

Table 4.—Distribution of spoils by total soluble-salt classes, in percent

Soluble-salt class (mmhos/cm)	Shrub blocks Site 1	Shrub blocks Site 2	Tree blocks Site 1	Tree blocks Site 2
0.01 to 0.25	38.6	76.9	43.3	72.8
0.26 to 0.50	48.6	21.1	49.6	23.7
0.51 to 0.75	7.1	1.7	4.9	1.0
0.76 to 1.00	2.7	.3	1.6	1.3
1.01 +	3.0	—	.6	1.2

Table 5.—Distribution of spoils by available-phosphorus classes, in percent

Available-phosphorus class (ppm)	Shrub blocks Site 1	Shrub blocks Site 2	Tree blocks Site 1	Tree blocks Site 2
0 to 3	23.7	93.0	16.1	96.3
4 to 6	38.8	6.2	39.1	3.1
7 to 9	26.1	.4	27.6	.6
10 to 12	8.6	.4	13.8	—
13 to 15	2.1	—	3.4	—
16 to 18	.7	—	—	—

At Site 2, the spoil was a mixture of sandstone and shale having a brown to gray color. Half of the blocks were established on extremely acid spoil that had a pH of 4.5 or less. The other blocks had spoils with near-neutral to slightly alkaline reaction. All spoils had a very low soluble-salt concentration. Seventy-five percent had concentrations of 0.25 mmhos/cm or less. Available phosphorus was very low (3 ppm or less) at 95 percent of the sample points. The spoil was less than a year old. All blocks were established on a regraded bench.

The variation in site characteristics between Sites 1 and 2 and the extremes within Site 2 permitted comparisons of survival and growth with pH and phosphorus values. For these evaluations, the acid spoils of Site 2 were designated Site 2-A; and the neutral to slightly alkaline spoils were referred to as Site 2-B.

RESULTS

Tree Species

The 28 species of trees were grouped into three classes: (1) commercially important; (2) noncommercial or ornamentals; and (3) species that could be classified either as tall shrubs or as small trees. For each species, survival and total height were computed by sites and for both sites combined.

Silktree, thornless honey locust, and hawthorn had the highest survival rates for those species planted on both sites (table 6). Scarlet oak planted on three plots on Site 2 survived well. Siberian elm and French tama-

Table 6.—Survival of tree species, in percent

Species	Site 1	Site 2	Both Sites
COMMERCIALLY IMPORTANT			
Scalet oak	*	85	85
Littleleaf linden	40	46	42
Pin oak	42	40	41
White cedar	*	40	40
Yellow birch	35	44	40
Sweet birch	40	40	40
Sawtooth oak	*	33	33
Bur oak	29	27	28
White birch	35	17	26
Austrian pine	29	4	17
Blackgum	6	14	10
Japanese black pine	8	4	6
Fraser fir	0	6	3
Cucumbertree	0	2	1
NONCOMMERCIAL OR ORNAMENTAL			
Silktree	94	75	84
Thornless honeylocust	75	68	72
Siberian elm	67	33	51
Tree-of-heaven	46	54	50
Japanese pagodatree	29	69	49
Boxelder	21	35	28
Black mulberry	25	5	15
Sourwood	15	14	14
Russian mulberry	17	0	9
TALL SHRUBS OR SMALL TREES			
Hawthorn	56	64	62
French tamarisk	71	20	48
Siberian peashrub	44	46	45
American smoketree	21	4	13
White dogwood	13	6	10

* This species was not planted on this site.

risk survived well on Site 1. On Site 2, Japanese pagodatree ranked third in survival.

Japanese black pine, blackgum, Fraser fir, cucumbertree, Russian mulberry, and white dogwood had very low overall survival rates. Survival of Austrian pine, black mulberry, and American smoketree was low; but it was better on Site 1, which had more phosphorus and soluble salts.

Rapid growth is considered an advantage for site protection and yield. Of all tree species evaluated, European white birch made the most rapid growth (table 7). It grew equally well on both sites. French tamarisk, silktree, sweet birch, and yellow birch were ranked next in overall growth.

Cucumbertree and Fraser fir were definitely off-site, and grew very slowly. Sourwood, Japanese pagodatree, blackgum, and American smoketree grew slowly and could not be considered suitable trees for site protection.

Seven species ranked high in both survival and growth were used for comparison of tree response to selected chemical characteristics of the spoil. Two variables, pH and phosphorus, were used. Soluble salts were low on

Table 7.—Mean total height of tree species after four growing seasons, in feet

Species	Site 1	Site 2	Both Sites
COMMERCIALLY IMPORTANT			
White birch	8.5	8.1	8.4
Yellow birch	4.5	3.7	4.1
Sweet birch	4.3	3.7	4.0
Pin oak	3.5	6.5	3.8
Scarlet oak	—	3.5	3.5
Sawtooth oak	—	3.2	3.2
Japanese black pine	2.5	3.0	2.7
White cedar	—	2.4	2.4
Bur oak	2.6	1.9	2.3
Austrian pine	2.0	.7	1.8
Littleleaf linden	1.2	2.0	1.6
Blackgum	1.8	1.4	1.5
Cucumbertree	—	.5	.5
Fraser fir	—	.5	.5
NONCOMMERCIAL OR ORNAMENTAL			
Silktree	5.7	4.0	4.9
Tree-of-heaven	3.9	5.8	3.8
Siberian elm	3.2	4.2	3.5
Boxelder	2.7	4.4	2.8
Black mulberry	3.6	3.3	2.7
Russian mulberry	2.4	—	2.4
Thornless honeylocust	2.4	2.2	2.3
Japanese pagodatree	1.2	1.7	1.4
Sourwood	.8	1.6	1.2
TALL SHRUB OR SMALL TREE			
French tamarisk	6.0	11.0	7.0
White dogwood	2.1	3.6	2.4
Hawthorn	2.4	2.1	2.2
Siberian peashrub	1.5	2.4	2.0
American smoketree	1.8	.4	1.6

Table 8.—Mean height and survival of tree species, by site

Species	Site	Mean height	Survival	Site characteristics: pH	Soluble salts	P
		Feet	*Pct.*	*pH*	*mmhos/cm*	*ppm*
White birch	1	8.6	35	3.8	0.298	5.8
	2-A	8.4	21	3.8	.166	.9
	2-B	5.9	13	7.1	.210	1.9
Yellow birch	1	4.5	35	4.1	.267	8.1
	2-A	5.0	50	3.8	.197	1.9
	2-B	6.1	50	7.4	.319	2.2
Sweet birch	1	5.9	40	4.1	.248	8.6
	2-A	2.7	25	3.8	.171	1.1
	2-B	2.5	54	7.4	.175	1.8
Pin oak	1	3.5	42	3.8	.293	6.4
	2-A	3.3	38	3.9	.215	1.9
	2-B	1.6	44	7.6	.196	1.5
Silktree	1	5.7	94	4.3	.243	8.1
	2-A	3.8	68	4.0	.209	2.2
	2-B	4.5	80	7.1	.205	1.6
Tree-of-heaven	1	3.9	46	4.2	.245	8.8
	2-A	3.8	43	4.1	.249	1.8
	2-B	3.1	70	7.5	.160	2.9
French tamarisk	1	6.0	71	4.1	.359	8.4
	2-A	—	0	3.7	.264	1.3
	2-B	8.7	60	7.3	.211	2.7

all sites and probably did not influence survival or growth.

The plots on Site 2 were subdivided into two groups for these comparisons. Site 2-A included plots having low pH and very low phosphorus. The Site 2-B plots were characterized by high pH and very low phosphorus. Tree growth on these two plots was compared to the survival and growth on all plots on Site 1. The Site 1 plots had low pH and low phosphorus.

Sweet birch and silktree made their best growth on Site 1. This site was characterized by a pH around 4.0, and by 6 to 8 ppm phosphorus. These same species made slower growth and had lower survival on Site 2-A. The Bray No. 1 test indicated about one-fourth as much phosphorus in the Site 2-A spoil as in the Site 1 spoils.

On Site 2-B, which was characterized by a pH of 7 to 8 and 1 to 3 ppm phosphorus, European white birch, sweet birch, pin oak, and silktree made their slowest growth. Yellow birch and French tamarisk had high survival and grew well on this site. The growth of tree-of-heaven was similar on all sites, but survival was best on Site 2-B (table 8).

Shrub Species

Many shrub species are characteristically low-growing plants that range widely in stem form. These were grouped by the following height classes: (1) maximum height 4 to 6 meters; (2) maximum height 1 to 3 meters; and (3) species with trailing stems. The survival and total height of each shrub species were computed for individual sites and for both sites combined.

Thorny olive and Japanese fleeceflower had the highest survival on both sites (table 9). Indigobush planted on Site 1 and buttonbush planted on Site 2 had high survival, but their adaptability to different site conditions could not be determined. These species should be evaluated in future studies.

Arrow-wood viburnum, blueleaf honeysuckle, Russian olive, cherry prinsepia, scotch broom, and all of the shrubs with trailing stems had very low survival. The use of these species on sites with similar characteristics should be discouraged because they have no specific advantage over other species.

Growth of autumn, thorny, and cherry olive was better than that of many other shrubs (table 10). Russian olive may not be adapted to these sites because only a few plants survived on the neutral spoils on Site 2. Japanese fleeceflower and multiflora rose grew well and had higher survival and growth on Site 1.

Species that grew very slowly were blueberry, Catawba rhododendron, cherry prinsepia, and rugosa rose. These probably would provide little site protection after 4 years' growth on acid surface-mine spoils.

Growth and survival were used to identify species poorly adapted to acid sites. On this basis, Chinese lilac, blueleaf honeysuckle, cherry prinsepia, Catawba rhododendron, dewberry, blackberry, and rugosa rose were judged to be least suited to these sites.

Seven species ranked high in both survival

Table 9.—Survival of shrubs, in percent

Species	Site 1	Site 2	Both sites
4 TO 6 METERS TALL			
Indigobush	90	*	90
Common buttonbush	*	83	83
Thorny olive	65	90	76
Peking cotoneaster	64	38	51
Autumn olive	54	42	48
Amur privet	42	38	40
Chinese privet	44	6	29
Chinese lilac	6	43	24
Arrow-wood viburnum	10	18	14
Blueleaf honeysuckle	15	3	9
Russian olive	0	14	7
1 TO 3 METERS TALL			
Japanese fleeceflower	96	66	80
Coralberry	65	55	60
Cherry olive	44	56	50
European barberry	40	48	43
Blueberry	27	60	42
Silky dogwood	40	25	34
Catawba rhododendron	19	40	28
Shrubalthea	15	41	27
Tartarian honeysuckle	38	15	26
Oakleaf hydrangea	21	25	23
Cherry prinsepia	*	17	18
Scotch broom	8	0	4
TRAILING STEMS			
Rugosa rose	19	14	16
Blackberry	14	13	14
Multiflora rose	14	4	11
Dewberry	11	6	9

* This species was not planted on this site.

Table 10.—Mean total height of shrubs species after four growing seasons, in feet

Species	Site 1	Site 2	Both sites
4 TO 6 METERS TALL			
Autumn olive	5.3	5.5	5.4
Russian olive	—	4.9	4.9
Thorny olive	3.3	5.3	4.5
Amur privet	3.0	3.6	3.3
Common buttonbush	—	2.9	2.9
Indigobush	2.4	—	2.4
Peking cotoneaster	2.0	2.6	2.2
Arrow-wood viburnum	2.2	2.0	2.1
Blueleaf honeysuckle	1.6	4.2	2.0
Chinese privet	2.0	1.0	1.9
Chinese lilac	2.1	1.8	1.9
1 TO 3 METERS TALL			
Cherry olive	3.5	5.1	4.4
Japanese fleeceflower	4.8	3.7	4.3
Scotch broom	3.4	—	3.4
Silky dogwood	2.5	3.6	2.8
Shrubalthea	2.3	2.7	2.6
Tartarian honeysuckle	2.2	2.9	2.4
Oakleaf hydrangea	2.2	2.5	2.4
Coralberry	1.3	2.8	2.0
European barberry	1.4	1.6	1.5
Blueberry	1.3	1.4	1.4
Catawba rhododendron	1.1	.9	1.0
Cherry prinsepia	—	.8	.8
TRAILING STEMS			
Multiflora rose	5.5	.6	4.9
Dewberry	3.7	.8	2.8
Blackberry	2.4	1.1	1.8
Rugosa rose	1.4	1.3	1.4

and growth, and these were used for comparisons of shrub response to selected chemical characteristics of the spoil. Two variables, pH and phosphorus, were used. Soluble salts were low on all sites and probably did not influence survival or growth.

The plots on Site 2 were subdivided into two groups for these comparisons. Site 2-A included plots having low pH and very low phosphorus. Site 2-B plots were characterized by high pH and very low phosphorus. Shrub growth on these two plots was compared to the survival and growth on all plots on Site 1. The Site 1 plots had low pH and low phosphorus.

All species except Japanese fleeceflower made their best growth on Site 2-B (table 11). This site was characterized by high pH and very low phosphorus. Survival of autumn olive, thorny olive, cherry olive, Amur privet, and coralberry was higher on Site 2-B and lowest on Site 2-A.

Comparisons of growth and survival for these seven species by site indicate important trends. Six of the seven species made their best growth on spoils of high pH and

Table 11.—Mean height and survival of shrub species, by site

Species	Site	Mean height	Survival	Site characteristics		
				pH	Soluble salts	P
		Feet	*Pct.*	*pH*	*mmhos/cm*	*ppm*
Autumn olive	1	5.4	54	3.6	0.273	4.4
	2-A	3.1	17	4.2	.461	2.7
	2-B	6.1	67	6.8	.231	1.8
Thorny olive	1	4.4	65	3.8	.322	6.6
	2-A	5.7	63	3.8	.241	1.1
	2-B	7.8	100	7.2	.155	2.7
Japanese fleeceflower	1	4.8	96	4.4	.186	6.9
	2-A	3.2	71	3.8	.207	2.2
	2-B	4.0	63	7.3	.177	1.1
Cherry olive	1	3.5	44	3.9	.269	8.5
	2-A	2.6	38	3.7	.207	1.5
	2-B	6.4	75	7.0	.195	1.7
Silky dogwood	1	2.5	40	3.9	.288	6.0
	2-A	2.5	8	4.4	.188	6.6
	2-B	3.7	13	7.4	.170	.9
Amur privet	1	3.0	42	3.7	.357	6.8
	2-A	2.7	29	3.9	.211	2.9
	2-B	4.4	50	7.4	.155	1.6
Coralberry	1	1.3	65	3.7	.334	5.9
	2-A	2.2	42	4.0	.217	2.8
	2-B	3.1	88	7.5	.163	5.2

very low phosphorus. Survival of three of these same species was highest on the same spoil. Japanese fleeceflower was the only species that had high survival and grew well on the acid low-phosphorus Site 1. Low survival and slow growth characterized silky dogwood on all sites.

CONCLUSIONS

In this study several species of trees and shrubs that are adapted to planting on acid surface-mine sites were identified. Species least suited to the spoils on the experimental sites were also identified.

Three species of birch ranked high in survival and growth. European white birch and sweet birch were adapted to low pH spoils, while yellow birch grew best on the neutral spoils. It is believed that these as well as other species of birch should be grown in nurseries supplying stock for surface-mine reforestation. Additional research will be required to determine for each species the site requirements and growth on a range of spoil conditions.

Pin oak ranked high in survival and growth. Scarlet oak grew well on a few plots characterized by acid spoils. This raises a question about the suitability of other species from the red oak group for spoil-bank reforestation. Northern red oak (*Quercus rubra* L.) is used extensively for surface-mine reforestation. It is possible that black oak (*Quercus velutina* Lam.), scarlet oak (*Quercus coccinea* Muenchh.), pin oak, (*Quercus palustris* Muenchh.), and other red oaks may also he desirable for surface-mine reforestation.

Silktree, tree-of-heaven, and French tamarisk are species of little or no commercial value that survived and grew well on both sites. French tamarisk was better adapted to the neutral spoils, and silktree and tree-of-heaven to the more acid spoils having low to moderate phosphorus. Silktree is a legume, and would serve as a soil builder and nurse crop for commercially valuable tree species. Tree-of-heaven and French tamarisk would be useful for site protection and aesthetics.

The excellent survival and growth of three of the four species of *Eleagnus* indicate that the genus is well adapted to a range of spoil conditions. Autumn olive is widely used for site protection and as a wildlife food plant, but other species of olive may be as effective on some sites.

Silky dogwood and coralberry are promising wildlife food shrubs. Coralberry survived well on a range of sites, but grew best on the neutral spoils. Silky dogwood grew well on the neutral spoils, but survival was poor on all sites.

Fleeceflower and Amur privet are adapted to a range of sites. These species have little value except for site protection and aesthetics.

False indigo and buttonbush should be considered in future evaluations. Both survived and grew well on acid sites. False indigo is a legume, and both are considered attractive wildlife shrubs.

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