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Field Guide for Managing Siberian Elm in the Southwest

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Cover Photos

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Siberian elm (*Ulmus pumila* L.)

Elm family (Ulmaceae)

Siberian elm is common in southwestern States and is listed as a noxious tree in New Mexico. This field guide serves as the U.S. Forest Service's recommendations for management of Siberian elm in forests, woodlands, and rangelands associated with its Southwestern Region. The Southwestern Region covers Arizona and New Mexico, which together have 11 national forests. The Region also administers 4 national grasslands located in northeastern New Mexico, western Oklahoma, and the Texas panhandle.

Description

In moist environments, Siberian elm (synonyms: Asiatic elm, dwarf elm, and Manchurian elm) is a fast-growing, hardy, mid-sized (60 to 70 feet tall), deciduous tree. In drier locations, it is smaller and takes on a shrubby appearance. Siberian elm has an open crown with upward-growing branches and many flexible, pendulous, brittle branchlets that easily break off. There is usually a large accumulation of leaves and woody litter that build up in the understory beneath Siberian elm. Siberian elm is often confused with Chinese elm, *Ulmus parvifolia*, which grows only to 30 to 40 feet in height and typically has leaves longer than 2 inches.

Growth Characteristics

- Deciduous tree (up to 70 feet tall) with an open, rounded crown that is 3/4 as wide as it is tall; slender, spreading branches.
- Trunk has rough grey or brown bark with shallow, irregular furrows.
- Twigs are silver-grey, yellowish, or grayish-brown, zigzag-shaped with a leaf bud at each bend and scattered spots (lenticels).
- Alternate leaves; 0.5 to 2.5 inches long, tapered at each end with a simple serrate or entire margin; upper surface deep green; lower surface paler green with hairs along vein axils. Leaves may turn yellow in autumn.
- Clusters of 2 to 5 small, green, drooping flowers without petals occur from February through April before leaves develop.
- Reproduces primarily via seed; roots re-sprout when top growth is damaged.
- Clusters of smooth, circular, winged, samara-type fruit with single seed in the center occur from April to May.

Ecology

Impacts/Threats

With adequate soil moisture, Siberian elm germinates readily and grows rapidly. It quickly out-competes desirable native plants, especially in sparsely vegetated or disturbed areas. A high density of Siberian elm can reduce shade-intolerant species (including quality forage) and decrease overall species diversity.

Site/Distribution

Siberian elm prefers open areas but tolerates a wide range of conditions, which includes long periods of drought, cold winters, poor soil conditions, high winds, and low moisture. In the Southwest, it commonly grows on disturbed grounds, moist streambanks, pastures and rangelands, and rights-of-way along roads and railroads. Siberian elm does not tolerate flooding and seldom invades mature forest because of its high requirement for sunlight.

Spread

Siberian elm seed is primarily dispersed via wind, although seed may also be transported by water and animals. Seed may be carried long distances by adhering to surfaces and undercarriages of logging equipment and vehicles. The tree is still sold commercially and is used for shade, shelterbelts, and windbreaks in Oklahoma and Texas.

Invasive Features

Siberian elm can dominate new locations in just a few years due to its adaptability, high rate of seed production and germination, and rapid growth.

Management

It is very difficult to restore native plant communities with large infestations of Siberian elm. However, populations can be reduced with careful planning and long-term actions. Consider the following actions when planning a management approach:

- Maintain healthy and diverse plant communities to prevent or limit Siberian elm infestations.
- Limit disturbance and/or promptly revegetate disturbed areas with desirable perennial forage species, especially perennial grasses.
- Detect and eradicate new populations of Siberian elm as early as possible.
- Combine mechanical and chemical methods for most effective Siberian elm control.
- Implement monitoring and a follow-up treatment plan for missed plants and seedlings.
- Map and keep annual records of reported infestations.

Table 1 summarizes some management options for controlling Siberian elm under various situations. Further details on these management options are explained below. Choice of which method(s) to use will depend on a number of factors including where the population is located and the stage of tree life. Consider carefully the current land use and site conditions (accessibility, terrain, microclimate, other flora and fauna present, etc.). Other important considerations include treatment effectiveness, cost, and the number of years needed to achieve control. More than one control method may be needed for a particular site.

Physical Control

To control Siberian elm, it is necessary to destroy the root system. Physical control can be done on a range of scales—from individual plant removal (from hand tools to excavators) to broad-scale clearing (from tillers to bulldozers). Mechanical clearing often requires repeated applications.

Manual Methods

Hand removal – Newly emerged seedlings and saplings with a stem diameter less than 3/8 inch are easily removed by hand pulling or hoeing. Small trees with a stem diameter between 3/8 and 2.5 inches may be hand grubbed with a shovel, hoe, or weed tool such as the Weed Wrench™ or Root Talon™.

Suppression by cutting – In areas with just a few large trees, trunks may be cut close to the ground to remove top growth. Anticipate that root and trunk re-sprouts will return later in the growing season and will require repeated follow-up cutting. Cutting is more effective when followed up with a chemical treatment (see cut-stump treatment in the "Chemical Control" segment below).

Girdling – In late spring to midsummer on larger trees, use an ax, saw, or chain saw to make two horizontal, circumferential cuts around the entire trunk. Place one cut 3 to 4 inches above the other through the bark and cambial tissue. Using a blunt object, such as the ax head, knock off and remove the bark between the cuts. Care should be taken to remove only the bark and outside cambial tissue while minimizing damage to the wood (xylem). **Deeper cuts made into the wood often trigger Siberian elm into re-sprouting from the roots.** Leave girdled trees in place for 2 to 3 years and check periodically to ensure that cut edges in the bark do not grow together again. See the "Chemical Control" segment below for information about combining girdling with a herbicide application.

Mechanical Methods

Tractor-mounted grubbing implements are especially useful for control of scattered individual trees. A grubbing tool mounted as part of a tractor's front hydraulics can drive a blade into the soil to sever below the root crown and uproot the plant onto the surface. Grubbed Siberian elm should be piled, dried, and burned or mulched rather than left on the surface to prevent the plant from re-rooting. After treatment, it is necessary to monitor grubbed areas for 2 or 3 years and re-treat as necessary.

Table 1. Management options*

Site	Physical Control	Cultural Control	Biological Control	Chemical Control
Roadsides, irrigation ditches, fence lines, or non-crop areas	Seedlings (< 3/8" diam.) and saplings (3/8 to 2.5" diam.): dig or grub with shovel, hoe or weed tool. Small trees (2–3" diam.): remove individual plants using the cut/stump method. Larger trees (> 3" diam.): girdle trunks and leave in place or use cut-stump method. Where access is not limiting, remove trees with an excavator or backhoe. Control re-sprouts as needed.	Use seed, mulch, and fill materials certified to be weed-free. Train road crews to identify and report infestations along roads; implement requirements for vehicle operations. Use weed screens on irrigation canals.	Consider intensive, short-term grazing of seedlings and young trees with male goats.	Light infestations: for trunks < 3' diam. and less than 8' tall, use basal bark treatment; for trunks > 3" diam., girdle or use cut-stump with herbicide. Dense infestations: use foliar application with backpack sprayer; truck/ATV-mounted sprayer. Wash under vehicle after application to prevent spread.
Rangelands, pastures, or riparian corridors	Light infestations: use an individual plant method to remove trees. Dense infestations: remove stems with heavy machinery in the winter; follow-up with chemical treatment to control re-sprouts in late summer.	Reseed with certified, weed-free seed; fertilize and irrigate, if possible, to make desirable plants more competitive.	Same as above.	For light infestations with Siberian elm interspersed with desirable native plants, use a backpack sprayer to treat individual plants (basal bark, cut-stump, or girdling with herbicide). For dense infestations in disturbed areas with few desirable plant species present, use broadcast spraying.
Wilderness, other natural areas, and/or small infestations	Same as above.	Use seed certified to be weed-free. After passing through infested areas, inspect and remove seed from animals, clothing, and vehicles before entering treated or un-infested areas.	Same as above.	Same as above.

* Choice of a particular management option must be in compliance with existing regulations for the land resource.

Large-scale clearing – In areas densely infested with Siberian elm, consider removing trunks and stems during winter with heavy machinery such as an excavator or backhoe. Excavators can be used to remove individual trees selectively, and skilled operators of this equipment can efficiently remove the top growth and most root material. Pulled material should be immediately destroyed by shredding or piled for later burning, shredding, or mulching. Later in the summer, sprouting from incompletely extracted root parts is often common when left in the soil. Therefore, follow-up control with mechanical or chemical treatment will be necessary.

Prescribed Fire

Use of fire is usually not recommended for Siberian elm control. However, a prescribed burn may be used in certain fire-adapted areas to remove and suppress top growth. Depending on fire intensity, burning will control seedlings, but saplings and older trees will usually survive and regrow from the root system.

Cultural Control

Siberian elm is available for sale in nurseries and has been planted widely as a fast growing hedge or windbreak tree in conservation plantings. While the popularity of

using Siberian elm as a drought-resistant planting option is not as common as it was in the past, public education is still needed to raise awareness of the invasive shortcomings of the species.

Land managers, the local public, and road crews should be educated as to how to identify nonnative noxious species such as Siberian elm so they can help report all suspected infestations. Seed and materials used for mulch, forage, or fill should be certified to be weed-free. Vehicles, humans, and livestock should be discouraged from traveling through infested areas; and a program to check and remove seeds from vehicles and livestock should be implemented to help stop dispersal. If possible, weed screens should be used on irrigation water intakes in infested areas to prevent seed transportation in irrigation canals.

Biological Control

Grazing

While published research does not specifically address livestock grazing on Siberian elm, anecdotal information suggests mature male goats will selectively graze seedlings and young trees. An intensive, short-term, prescribed grazing approach with goats could be one component in a successful Siberian elm management program in selected areas.

Classical Biological Control

There are no classical biocontrol agents (insects, pathogens, etc.) currently approved by USDA for use with Siberian elm.

Chemical Control

Herbicide control—used either alone or in combination with another method—has been used with varying success on Siberian elm. The choice of which herbicide to use and how to apply it is influenced by many factors including the time of year to be sprayed, the plants particular growth form (i.e., a low growing, multi-stemmed shrub versus a mid-sized, single stem tree), site accessibly, and other considerations. The density of the Siberian elm population and proximity to other desirable plants further complicates how best to proceed with herbicide control.

Herbicide products recommended in table 2 will have different requirements and restrictions according to the label. Aquatically approved herbicide formulations and surfactants must be used in or near water. It is important to read and carefully follow all instructions and warnings provided on the herbicide label. Consult the registrant if you have questions or need further detail.

Herbicide Application

There are several registered products that can be applied in a variety of ways including (1) foliage application, (2) soil application, (3) topical application to cut-stems and stumps, and (4) basal spraying. Herbicide spraying is rarely successful as a one-time treatment so it should be anticipated that treated areas will need to be monitored for several years and re-sprouts and new seedlings will require further treatment. Care should always be taken when spraying any herbicide near desirable plants.

Foliar spraying may be used to control seedlings, saplings, and mature trees of Siberian elm that are generally less than 6 feet in height and are easily covered with a spray application. Apply herbicide to fully expanded leaves using individual plant treatment (IPT spot spray) with a backpack sprayer, or treat clusters of trees using a tractor or truck-mounted sprayer (broadcast application). Any equipment used to spray herbicide should be calibrated.

When using the IPT approach, take care to direct spraying so that desirable, nearby non-target plants are not harmed. Thoroughly wet all green leaves and shoots, especially near the top of the shrub or tree. Plants should be wetted without allowing dripping to occur. Use a 1.5 percent v/v solution mix using triclopyr (Garlon® 4) to spray IPT. Glyphosate, imazapyr, or a spray mixture of aminocyclopyrachlor combined with imazapyr and metsulfuron methyl (Viewpoint®) are also effective herbicide treatments as described in table 2. When mixing any herbicide solution, consult the label on the need to add a nonionic surfactant (a 0.25 percent by volume is usually added). Also, adding a blue indicator dye (0.5 percent) to the mixture is recommended to help view coverage of sprayed plants. The practicality of using a foliar spray approach depends primarily on tree density

Table 2. Herbicide recommendations

Common Chemical Name (active ingredient)	Product Example[1]	Broadcast Treatment (rate per acre)	Spot Treatment (spray solution)[2]	Time of Application	Remarks
Triclopyr	Garlon 4 [many others available]	3–6 quarts	Low volume: 1.5% High volume: 1–1.5%	Summer/early fall when tree is actively growing and fully leafed but before fall color begins.	Selective, systemic broadleaf herbicide; will not impact grasses. Low soil activity; no impact to groundwater. Follow label for quantity of water and nonionic surfactant to mix. Garlon 4 volatilizes above 86 °F.
Glyphosate	Rodeo, Roundup Pro [many others available]	Rodeo: 3–7.5 pints Roundup : 1.5–3.3 quarts	Rodeo: 0.75–1.5% Roundup: 1–1.5%	Same as above.	Nonselective herbicide; can injure surrounding plants and open more area for weeds. Follow label for how much water to mix.
Imazapyr	Arsenal Habitat Chopper Stalker [others available]	Arsenal: 1–1.5 pints Chopper: 2–3 pints	Arsenal: 1-5% Chopper: 5%	Same as above.	Nonselective herbicide; overspray can injure surrounding plants and open up additional area for weeds. In addition to spray drift, non-target plants may also be killed or injured by imazapyr through runoff, residue movement in soil, or root exudates from treated plants.
Aminocyclopyrachlor + imazapyr + metsulfuron methyl	Viewpoint	13–20 ounces	Consult label for spot applications.	Same as above.	Apply as high volume or broadcast foliar spray. Nonselective herbicide used on non-crop sites; may cause temporary injury to some grass species.

[1] Trade names for products are provided for example purposes only, and other products with the same active ingredient(s) may be available. Individual product labels should be examined for specific information and appropriate use with Siberian elm.

[2] Spray solution is the herbicide/water ratio in a spray mix that may be used for spot treatment with backpack or hand-held sprayers. The amount of product applied during an annual growing season must not exceed the maximum application rate per acre as specified by the product label – refer to the product label for the site type and application.

and access to the area to be sprayed. An efficient way for treating younger plants and re-sprouts across a large area is to use a team approach where each member equipped with a backpack sprayer walks side-by-side about10 feet apart and spot sprays plants in their zone. A blue or red indicator dye in the spray mixture is very helpful for determining coverage. Sprayed areas should be revisited after 2 or 3 years to re-treat surviving or missed plants.

Basal bark spraying is a highly selective, yet labor intensive method that is most appropriate for controlling smaller trees less than 8 feet tall with stems that are about 2 to 3 inches in diameter. Use a backpack sprayer equipped with an adjustable nozzle (X0 to X1) to deliver a mist spray from the base of the stem up to 12 inches above the ground. Spray a band of herbicide around the entire circumference of the stem until the bark is wet but not running off. A20 percent solution of triclopyr combined with 80 percent penetrating oil should be mixed and applied in the winter (January or February) or from mid-summer to early fall (June-September). Add blue dye to the chemical solution as an aid for determining coverage. Leave treated trees standing in place so they can be revisited the next year and, if necessary, new foliage can be spot sprayed.

Cut-stump treatment with herbicide allows specific trees to be immediately removed. Use a chain saw to cut the trunk as close to the ground as possible. Within 5 to 15

minutes of cutting, apply glyphosate to the cut surface using a paint brush, wick applicator, or low-volume hand-held sprayer. Although the product label indicates a 50–100 percent concentration of glyphosate should be used, literature indicates that a 20 percent glyphosate solution is effective in preventing root re-sprouts.

Girdling with herbicide, as described in part in the "Physical Methods" section above, is an effective control treatment for larger trees. Spray or paint the cut-surface of girdled areas with a 50–100 percent concentration of glyphosate or triclopyr. The most effective time to girdle and apply chemical treatment is during summer when Siberian elm is fully leafed-out and actively growing.

Management Strategies

The first priority in Siberian elm management is early detection and control to prevent widespread establishment. Small infestations on otherwise healthy sites should be given high priority for treatment. Siberian elm growing in riparian corridors along waterways should be treated by starting at the upper reaches of the drainage and then progressing downstream.

Numerous strategies have been used for Siberian elm control, and local situations usually dictate the best approach to follow. A popular approach is to use a basal spray or a cut-surface treatment initially and then follow up later by using a foliar active herbicide to spot spray new seedlings, sprouts, and root suckers. Once Siberian elm is controlled, planting desirable trees and other restoration activities may be used to help prevent the problem from recurring. This includes establishing a thick cover of competing vegetation (i.e., desirable trees, shrubs, and grasses) that can provide shade and crowd out Siberian elm.

Strategies to contain and reduce Siberian elm populations require long-term planning and integrated management. A combination of control methods applied over 5 to 10 years is usually necessary to provide effective control of Siberian elm. Since it is ordinarily useless to treat an area only one time without retreatment, sufficient resources must be allocated for the area where control is attempted. After initial treatment, it is especially important that resources are also available to respray or retreat the treated area as necessary. Regardless of the initial strategy used, the key to successful long-term control of Siberian elm is to monitor treated areas for several years after initial treatment. Always be prepared to remove any new plants quickly. Failure to perform follow-up monitoring and treatment could result in a return to pretreatment density levels.

Adaptive Management

It is important to establish realistic goals and objectives when managing Siberian elm, especially when infestations occur extensively across a given landscape. To improve long-term success, consider using an adaptive management approach with the overall goal of restoring desirable plant communities. The stepwise process for adaptive management involves:

1. Assessment of the overall weed problem,
2. Establishing management goals and objectives,
3. Implementation of control strategies and measures,
4. Monitoring the effectiveness of management actions,
5. Evaluating actual outcomes in relation to expected results, and
6. Adjusting practices as necessary.

Steps of this process should be repeated in sequence as part of a continuous learning cycle that improves management planning and strategy by learning from the outcomes of previous management actions. In general, an adaptive management approach may be considered to be successful if:

1. Stakeholders are actively involved and remain committed to the process,
2. Monitoring and assessment are used to adjust and improve management decisions, and
3. Management goals and/or objectives for the resource are being achieved.

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Suggested Web Sites

For information on invasive species:

National Invasive Species Information Center
http://www.invasivespeciesinfo.gov/

Invasive.Org
https://www.invasive.org/species.cfm

For information about calibrating spray equipment:

NMSU Cooperative Extension Service Guide A-613 *Sprayer Calibration.* Available at http://aces.nmsu.edu/pubs/_a/A-613.pdf

Herbicide labels online:

http://www.cdms.net/

For more information or other field guides, contact:

USDA Forest Service
Southwestern Region
Forest Health
333 Broadway Blvd., SE
Albuquerque, NM 87102

Or visit the Southwestern Region's website for invasive species:

http://www.fs.usda.gov/goto/r3/invasivespecies