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Field Guide for Managing Siberian Elm in the Southwest

Cover Photos

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Siberian elm (*Ulmus pumila* L.)

Elm family (Ulmaceae)

Siberian elm is common to 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 encompasses Arizona and New Mexico, which together have 11 national forests. The region also includes four 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 hardy, fast-growing, mid-sized, 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 builds up in the understory beneath Siberian elm.

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.
- Reproduces primarily via seed; roots resprout when top growth is damaged.
- Clusters of 2 to 5 small, green, drooping flowers without petals occur from February through April before leaves develop.
- Clusters of smooth, circular, winged, samara-type fruit with single seed in the center occur from April to May.

Ecology

Impacts/threats – With 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.

Location – Siberian elm prefers open areas but tolerates a wide range of conditions including 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, in pastures and rangelands, and along road and railroad rights-of-way. 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 western Oklahoma and Texas.

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

Management

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 within riparian corridors should be removed by starting at the upper reaches of the drainage and progressing downstream.

It is very difficult to restore native plant communities with a large infestation of Siberian elm. However, populations can be reduced with careful planning and long-term actions. Combined control methods applied over 5 to 10 years are usually necessary to provide effective control of Siberian elm. Strategies to contain and reduce Siberian elm populations require long-term planning and integrated management. 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, report, and eradicate new populations of Siberian elm as early as possible.
- Map known infestations. Keep annual records of reported infestations.
- Combine mechanical and chemical methods for most effective Siberian elm control.
- Implement monitoring and a followup treatment plan for missed plants and seedlings.

Table 1 summarizes some management options for controlling Siberian elm under various situations. Choice of which method(s) to use will depend on a number of factors

Table 1. Management options* (no biological control methods are currently available)

Site	Physical Methods	Cultural Methods	Chemical Methods
Roadsides, irrigation ditches, fence lines, or noncrop 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. Anticipate the need to control resprouts.	Train road crews to identify and report infestations along roads; implement requirements for vehicle operations. Use weed screens on irrigation canals.	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; followup with chemical treatment to control resprouts in late summer.	Reseed with certified, weed-free seed; fertilize and irrigate, if possible, to make desirable plants more competitive.	For light infestations with Siberian elm interspersed with desirable native plants, use a backpack sprayer to treat individual plants (basal bark, cut-stump, or girdle with herbicide). For dense infestations in disturbed areas with few desirable plant species present, use broadcast spraying.
Wilderness, natural areas, and/or small infestations	Same as above.	After passing through infested areas, inspect and remove seed from animals, clothing, and vehicles before entering treated or uninfested areas.	Same as above.

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

including tree life stage and where the population is located. Consider carefully the current land use and site conditions (accessibility, terrain, climate, 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 repeat 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 resprouts will return later in the growing season and will require repeated followup cutting. Cutting is more effective when followed up with a chemical treatment (see cut-stump treatment in the "Chemical Control" section).

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 only remove the bark and outside cambial tissue while minimizing damage to the wood (xylem). Deeper cuts into the wood often triggers the plant to respond as if it were cut down and causes the tree to resprout from the roots. Leave girdled trees in place for 2 to 3 years and check them periodically to ensure that the bark does not grow together again. See "Chemical Control" section for information about combining 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 rerooting. After treatment, it is necessary to monitor grubbed areas for 2 or 3 years and re-treat as necessary.

Large-scale clearing – In areas that are 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 is often common from root parts that were not extracted and were left in the soil. Therefore, followup 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 plants invasive shortcomings.

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. 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 suggest 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 Agents

There are no biological control agents currently approved for use on Siberian elm. Insects and diseases commonly associated with Siberian elm include elm leaf beetle (*Xanthogaleruca luteola*), aphids, *Tubercularia* canker, *Botryodiplodia* canker, powdery mildew, wetwood, leaf spot, and cankerworm.

Chemical Control

Herbicide control—used either alone or in combination with another method—has been applied 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, multistemmed 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 spraying is rarely successful as a one-time treatment so it is important to anticipate that treated areas will need to be monitored for several years and resprouts and new seedlings will require further treatment in the future. 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. Care should always be taken when spraying any herbicide near other desirable plants. Herbicide products recommended in table 2 will have different requirements and restrictions according to the label. 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 Control Methods

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). When using the IPT approach, take care to direct spraying so that desirable, nearby nontarget 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

Table 2. Herbicide recommendations

Common Chemical Name (active ingredient)	Product Example[1]	Product Example Rate per Acre (broadcast)	Backpack Sprayer Treatment Using Product Example[2]	Time of Application	Remarks
Triclopyr	Garlon 4, many others	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	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, and others	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 additional area for weeds. Nontarget plants may be killed or injured by root transfer of imazapyr between intertwined root systems.
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 noncrop 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] Herbicide/water ratio. As an example, a gallon of spray water with a 3 percent mixture is made by adding a sufficient volume of water to 4 ounces of liquid herbicide until a volume of 1 gallon is reached (4 oz ÷ 128 oz/gal = 0.03 or 3 percent).

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 on sprayed plants. The practicality of using a foliar spray approach is influenced primarily by tree density and access to the area to be sprayed. An efficient way for treating younger plants and resprouts across a large area is to use a team approach where each member equipped with a backpack sprayer walks side-by-side about 10 feet apart and spot sprays plants in their zone. A blue or red indicator dye in the 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. A 20 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 resprouts.

Girdling with herbicide, as described in part in the "Physical Methods" section, 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.

Control Strategies

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 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. 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 followup 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 an infestation occurs broadly across a given landscape. To improve long-term success, consider using an adaptive management strategy 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,
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 strategy 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.

References and Further Information

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Suggested Web Sites

For information on invasive species:

http://www.invasivespeciesinfo.gov/

http://www.invasive.org/weedus/index.html

For information about calibrating spray equipment:

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

Herbicide labels online:

http://www.cdms.net/LabelsMsds/LMDefault.aspx

Physical Methods How-to site online (includes information on weed tools):

http://www.dcnr.state.pa.us/forestry/invasivetutorial/Manual.htm

For more information or other field guides, contact:

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Or visit:

http://www.fs.usda.gov/main/r3/forest-grasslandhealth