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Field Guide for Managing Russian Olive in the Southwest

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Cover Photos

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Russian olive (*Elaeagnus angustifolia* L.)

Oleaster family (Elaeagnaceae)

Russian olive is widespread throughout the United States as a tree and is listed as a noxious weed in New Mexico. This field guide serves as the U.S. Forest Service's recommendations for management of Russian olive in woodlands, rangelands, and riparian areas 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

Russian olive (synonyms: oleaster, wild olive, and silver berry) is a hardy, fast-growing, deciduous tree that grows to about 30 feet in height. Russian olive is silvery in appearance and highly aromatic; its thorny branches are loosely arranged in a rounded shape.

Growth Characteristics

- Deciduous tree (10 to 40 feet tall) or long lived, multi-stemmed shrub; semi-shade tolerant.
- Trunk has a circumference of 4 to 20 inches; has dark, smooth, or sometimes shredded-looking bark.
- Branches are loosely arranged; reddish-brown with silvery scales; twigs are thorn tipped with silvery scales; 1to 2-inch thorns.
- Alternate, simple, lance-shaped leaves, 0.8 to 4 inches long; upper surface is pale green with silvery, star-shaped hairs; lower leaf has dense, silvery-white scales.
- Roots can grow as deep as 40 feet; symbiotic nitrogen-fixing bacteria in roots allow Russian olive to grow on bare-mineral substrate.
- Fragrant, yellow flowers arranged in clusters; flowers May to July.
- Clusters of small, hard, olive-like, yellowish to red-brown fruits (drupes, 0.5 inch long) with silver scales; fruit matures August to October.
- Reproduces primarily by seed, although sprouting from buds at the root crown and suckers from lateral roots also occur.
- Seeds are brown, oval shaped 0.25 to 0.5 inch long; seed produced after tree is 4 to 5 years old; seed viable for 3 years.

Ecology

Impacts/Threats

Russian olive is problematic in the Southwest because it favors riparian communities and other moist environments. As infestations increase, Russian olive crowds out desirable native riparian vegetation such as cottonwood and willow, thereby reducing flora and fauna species diversity. Because of its ability to colonize streambanks, Russian olive can alter the natural flooding regime and reduce availability of nutrients and moisture.

Site/Distribution

Russian olive prefers areas where the water table is near the soil surface such as riparian zones, floodplains, valley bottoms, and sub-irrigated pastures or grasslands. It commonly grows near water tanks, irrigation ditches, and springs; also along roadsides, railways, and fence lines.

Over the past century, Russian olive was widely planted throughout the United States as an ornamental and windbreak tree that has since escaped into natural areas. It occurs from sea level to about 8,000 feet of elevation.

Spread

Russian olive seed is ingested by birds, and bird droppings containing the seed contribute greatly to the tree's spread. Coyotes, deer, and raccoons also consume the fruit as a food source which facilitates seed dispersal as does seed-caching activities of small mammals. The fruit floats and is easily transported and dispersed along waterways. Russian olive also grows and spreads from stump sprouts, stem cuttings, and root pieces, especially after parent trees have been cut.

Invasive Features

Russian olive tolerates a wide range of environmental conditions including high winds, flooding, drought, extreme temperatures (-50 °F to 115 °F), saline or alkaline soil conditions, and competition from other trees and shrubs. Russian olive can become the dominant species in areas after invasion due to its adaptability, aggressive reproduction, and rapid growth rate. It may form dense, monotypic stands that can impede establishment of willow and cottonwood seedlings.

Management

It is extremely difficult to restore native plant communities in areas once Russian olive has become well established. The first priority in Russian olive management is to prevent establishment by monitoring for its first appearance. It may be impractical to eradicate Russian olive completely when growing in larger infestations, but trees should be controlled to the best extent possible. Control efforts must focus on the destruction of the root system; therefore, treatments such as dozing, burning, and cutting will effectively eliminate above-ground growth but do little to control the root system and limit recruits.

The following actions should be considered when planning an overall management approach:

- Maintain healthy and diverse plant communities.
- Provide landowners with ideas for non-invasive alternatives to Russian olive for soil stabilization, windbreaks, and ornamental use.
- Limit disturbance and/or promptly revegetate disturbed areas with desirable riparian plant species such as cottonwood and willow.
- Where possible, maintain or simulate seasonal flooding in riparian areas.
- Eradicate new populations of Russian olive as early as possible.
- Detect, report, and map large infestations. Keep annual records of reported infestations.
- Combine mechanical, cultural, and chemical methods for most effective Russian olive control.
- Implement monitoring and follow-up treatment plan for missed plants and seedlings.

Table 1 summarizes some management options for common situations involving Russian olive. Further details on these management options are explained below. Choice of which method(s) to use for Russian olive control will depend on a number of factors including the age, size, and density of trees. Site conditions (land use, accessibility, terrain, microclimate, other flora and fauna present, etc.) where the infestation occurs will greatly influence management. Other 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.

Special Considerations

Along with saltcedar (*Tamarix* spp.), Russian olive potentially serves as nesting habitat for the endangered southwestern willow flycatcher *(Empidonax traillii extimus)* which is protected under the Endangered Species Act of 1973. To avoid harm to this endangered species, information should be obtained from the U.S. Fish and Wildlife Service (Arizona, phone (602) 242-0210; New Mexico, phone (505) 248-6920) before implementing treatment of Russian olive stands of 0.25 acre or more in riparian or wetland areas within Arizona or New Mexico. A formal survey for flycatcher nesting habitat by a surveyor with a scientific permit may be required for a site with Russian olive prior to treatment if the nesting status of the site is undetermined. Within occupied or suitable flycatcher habitat, Russian olive treatment operations (including ground or aerial herbicide spraying) should not occur during the flycatcher nesting period of April 15 to August 30. When nesting habitat of the southwestern willow flycatcher is present, a no-treatment buffer of 0.25 mile is necessary around the nest(s). Migratory birds other than the flycatcher may also nest in Russian olive from April through August, and treatment of Russian olive during this period should be avoided if possible.

Table 1. Management options*

Site	Physical Control	Cultural Control	Biological Control	Chemical Control
Roadsides, irrigation ditches, fence lines, or non-crop areas	Saplings (< 3.5 inch diam.): dig up with shovel, hoe, or weed tool. Larger trees (> 3.5 inch diam.): extract with an excavator or backhoe. Anticipate the need to control re-sprouts.	Educate the public, road crews, and others to identify and report infestations. Implement requirements for vehicle operations.	If allowed, consider using trained goats to graze Russian olive seedlings and young trees selectively in a short-term prescribed grazing approach.	Light infestations: use basal bark treatment for stems < 5 inches diam. For stems > 5 inches diam., use cut-surface with herbicide (cut-stump, girdle, or injection). Dense, monotypic infestations: use foliar application with backpack sprayer; truck or ATV-mounted sprayer. Wash under vehicle after application to prevent spread.
Rangelands, pastures, or riparian corridors	Seedlings: hand pull or burn. If feasible, use physical methods in a combined strategy with prescribed grazing by using older male goats. Saplings (< 3.5 inches diam.): grub with hoe or weed tool. Larger trees (> 3.5 inches diam.): use heavy equipment. Consider a combined approach with chemical spraying.	Implement an early identification and reporting program with rapid response for new infestations. Use weed screens on irrigation canals. Check vehicles for seeds. Reseed with certified, weed-free seed; if possible, fertilize and irrigate to make desirable plants more competitive.	Consider using trained goats to graze Russian olive seedlings and young trees selectively in a short-term prescribed grazing approach.	Consider using individual plant treatment (i.e., spot spraying foliage; basal bark applications; cut-stump, girdling, or injecting with herbicide) for light infestations, areas with difficult access, or areas with desirable native plants. For dense infestations with few desirable plant species present, use ground or aerial broadcast spraying.
Wilderness, other natural areas, and/or small infestations	Seedlings and sprouts: hand pull. Saplings (< 3.5 inches diam.): grub with hoe or weed tool. Larger trees (> 3.5 inches diam.): combine physical methods with herbicide spraying.	Post signs informing visitors to watch for and report Russian olive seedlings or plants. After passing through infested areas, inspect and remove any seeds from animals, clothing, and vehicles before entering treated or un-infested areas.	Consider using trained goats to selectively graze Russian olive seedlings and young trees in a short-term prescribed grazing approach.	Use basal bark treatment, cut-surface with herbicide, or individual plant foliar treatment with a backpack or hand-held sprayer. Broadcast spraying of foliage by aerial or ground methods may be used on thicker stands if allowed.

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

Physical Control

Physical methods to control Russian olive should focus on reducing seed production and preventing germination, mainly through removal or impairment of seed producing plants. Methods that stress and/or remove the root system should also be employed. These methods usually have to be followed up with repeated treatment of seedlings and root re-sprouts. Long-term effectiveness may be increased by applying herbicide after cutting.

Manual Methods

Hand removal – Small trees (< 3.5 inches diameter) may be hand grubbed with a shovel, hoe, or weed tool such as the Weed Wrench™ or RootTalon™.

Mechanical Methods

Suppression of saplings by mowing – Where sapling stems do not exceed 1 inch in diameter, use a tractor fitted with a brush mower to shear plants close to the ground

surface. Gather and pile cut material for burning or shredding. Mowing will not kill Russian olive trees, and plants can become multi-stemmed and brushy if mowing is not repeated. Repeat mowing before saplings reach a diameter of 1 inch (likely annually). A wet-rotary blade with glyphosate may also be considered for a combined approach.

Tillage – Russian olive is sensitive to repeated tillage, especially its seedlings and saplings. This approach is only practical in agronomic situations and should be done in coordination with reseeding and pasture renovation. Disks and plows effectively sever shallow roots. Root sprouting may occur after the first tillage operation so this practice usually has to be repeated. By using tillage in concert with broadleaf weed control spraying, Russian olive saplings may be effectively control.

Large-scale clearing – In areas that are densely infested with Russian olive, consider removing trunks and stems in the winter with heavy machinery (such as an excavator). Pulled material should be immediately destroyed by shredding or else piled for later burning. This method is efficient at removing top growth and most root material. However, sprouting often occurs from root parts that remain in the soil (especially from lateral roots). Therefore, consider this approach as being more effective when combined with follow-up chemical control.

Prescribed Fire

Burning will modestly control saplings and can reduce top growth of larger, more mature Russian olive. Since trees will vigorously re-sprout at a later time after burning, prescribed fire should always be considered to be a suppression technique rather than as a method for eradication. Spring and winter burns are usually less effective than summer or early fall burns.

Cultural Control

Russian olive is viewed by some people as a horticulturally desirable species, and the tree is still sold in nurseries. In the past, it was promoted by various governmental agencies for conservation plantings; however, some of these same agencies are now spending large sums of money to control it. Although planting Russian olive as a drought-resistant windbreak tree is not encouraged as it was in the past, public education is still needed to raise awareness of the tree's invasive potential.

Public participation in prevention, early detection, and tree removal is critical for limiting the spread of Russian olive. Vehicles, humans, and livestock should be discouraged from traveling through infested areas. Wherever feasible, a program to check and remove seed from vehicles and livestock after travel through infested areas should be implemented to help stop spread. To prevent seed from being transported in irrigation canals, use weed screens on irrigation water intakes inside infested areas if possible.

Biological Control

Grazing

Mature, trained goats will selectively graze Russian olive seedlings and young trees. A short-term, prescribed grazing approach with goats may not completely eradicate Russian olive but could serve as one component in a successful control strategy.

Classical Biological Control

Research is currently underway to identify classical biocontrol agents (insects, pathogens, etc.) for Russian olive; however, none are currently approved for release at this time.

Chemical Control

Herbicide control used either alone or in combination with another method has been applied with varying success on Russian olive. The density of the Russian olive population and the proximity to 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 sites will need to be monitored for several years and new seedlings and that re-sprouts will require further treatment in the future.

Herbicides recommended in table 2 will control Russian olive when properly applied. Most compounds available for Russian olive control have post-emergent activity and provide limited pre-emergent control. Choice of which herbicide to use and the best method of application are

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
Glyphosate	Rodeo Roundup Pro [others available]	Rodeo: 3–7.5 pints Roundup: 1.5–3.3 quarts	Rodeo: 1.5–3.5% Roundup: 5%	Foliar spot treatment: spring (April to May). Frill or injection: winter	Nonselective herbicide; can injure surrounding plants and create more area for weeds. Frill, girdle, or injection: 50–100% concentration. Follow label for mixing instructions.
Imazapyr	Habitat Arsenal [others available]	2–4 pints	1.0%	Summer to fall (Aug. to Sept.); when actively growing and fully leafed.	Use foliar spray for seedlings and saplings. Frill or girdle: use undiluted; cut-stump: use 10% imazapyr with 90% methylated seed oil. Habitat okay for riparian use. This herbicide is a non-selective amino acid inhibitor and will kill desirable vegetation, including forbs and woody species. 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.
Imazapyr + glyphosate	Arsenal + Rodeo	1.5 quart + 1.5 quarts	1/2–1 gallon + 1/2–1 gallons (1–2 pounds + 2–4 pounds) per 100 gallons water with 0.25% surfactant and a blue indicator dye	Same as imazapyr.	Same as imazapyr.
Triclopyr	Garlon 4 [others available]	1–3 quarts	Low volume: 1.0 % High volume: 0.5% Re-sprouts: 25%	Basal bark: winter to early spring. Foliar spot treatment: in early summer; use when tree is actively growing and fully leafed.	Selective, systemic broadleaf herbicide; low soil activity. For basal bark or cut-surface, use 25-50% v/v triclopyr with 50-75% carrier oil. Follow label for mixing instructions. Garlon 4 volatilizes above 86 °F.
Triclopyr + 2,4-D[3]	Crossbow	2 gallons	High volume: 1.5%	Basal bark: winter to early spring. Foliar: After full leaf (late spring to early summer).	Foliar or basal bark; low volatility; wait 3 weeks to reseed since it may inhibit germination and growth.

Table 2. Herbicide recommendations (cont.)

Common Chemical Name (active ingredient)	Product Example[1]	Broadcast Treatment (rate per acre)	Spot Treatment (spray solution)[2]	Time of Application	Remarks
Triclopyr + 2,4-D[3]	Crossbow	2 gallons	High volume: 1.5%	Basal bark: winter to early spring. Foliar: After full leaf (late spring to early summer).	Foliar or basal bark; low volatility; wait 3 weeks to reseed since it may inhibit germination and growth.
Aminopyralid + triclopyr	Milestone + Garlon 4	7 ounces + 2 quarts	In 100 gallons of water, add 7 ounces Milestone and 3 quarts Garlon 4; add 1 quart nonionic surfactant.	Foliar spot spray on healthy foliage in spring or summer.	Treatments can be made to smaller trees < 6 feet in height or to root and stem sprouts previously cut.

[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 Russian olive.

[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.

[3] 2,4-D is a restricted use pesticide in New Mexico only. A certified applicator's license is required for purchase and use.

influenced by many factors including the time of year to be sprayed, plant growth form (i.e., a growing, multi-stemmed shrub vs. a mid-sized, single-stem tree), site accessibly, and other considerations. Aquatically approved herbicide formulations and surfactants must be used in or near water. Each herbicide product will have different requirements and restrictions according to the label. Read and understand prior to any application. Consult the registrant if you have questions or need further detail.

Herbicide Application

Sites planned for spraying should be closely evaluated in advance before proceeding with a herbicide control program. Herbicides may be applied by a number of methods including backpack or hand-held sprayers, ATV or UTV sprayers, boom sprayers that are pulled or attached to a tractor or truck, and by aerial spraying with a helicopter or fixed-wing aircraft. Any equipment used to spray herbicide should be calibrated.

Treatment options include foliar application, basal bark, and cut-surface methods, which are described below:

Foliar treatment methods – IPT or foliar spot spraying may be used to control seedlings, saplings, and mature Russian olive that are generally less than 6 feet in height. The practicality of using this approach is influenced primarily by the density and access to the trees to be sprayed. Care needs to be taken to direct spraying so that desirable nearby, non-target plants are not harmed. When mixing the herbicide solution, consult the label on the need to add a nonionic surfactant (usually 0.25 percent by volume is added). Also, adding a blue indicator dye (0.5 percent) to the mixture is recommended to help view coverage on sprayed plants. 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.

Re-sprouts are common after top growth of Russian olive has been removed by operations that involve cutting, tillage, extracting, or shredding; spot spraying is an effective way to control new or returning plants. Wait until plants are about 3 feet tall and have sufficient foliage to allow uptake of herbicide. This may be a year or two after original trees were removed. One successful way for treating re-sprouts across

a large area is to use a team approach whereby each member equipped with a backpack sprayer walks side-by-side about 10 feet apart and sprays plants within their zone. Treated areas should be revisited after 2 or 3 years to respray surviving or missed plants. A 5 percent v/v solution mix using Roundup® early in the season, or a mixture of Milestone® plus Garlon® 4 or imazapyr used later in the season as described in table 2 are effective herbicide treatments.

Airplane or helicopter applications can be used to spray mature Russian olive in selected situations. Aerial spraying is usually most practical on mature Russian olive growing in dense, nearly monotypic stands. The aircraft used should be equipped with a satellite guidance system and an onboard GIS display system for spraying in wildland situations. Areas to be sprayed should be pre-mapped and the onboard computer spray system should be preprogrammed to apply herbicide only on defined treatment areas. Helicopters can spray difficult, "tight" areas that require precision application such as edges of meandering rivers or Russian olive stands interspersed with non-target vegetation. Fixed-wing aircraft are better for spraying large, monotypic blocks of Russian olive where an overlapping spray pattern can be delivered at a lower operational cost than by a helicopter.

Herbicides available for aerial application will defoliate and suppress Russian olive, but complete control is rare. Anticipate that follow-up treatments, such as mechanical control, may be needed in later years. When aerially spraying large trees, the spray volume should be sufficiently high to insure maximum spray coverage. Spray nozzles should be fitted to deliver moderate to large-sized droplets ranging from 450 to 1,200 µm. As indicated in table 2, a spray mixture may include 2 quarts of imazapyr or a 1.5 quart imazapyr plus 1.5 quart glyphosate mixture applied in water. A nonionic surfactant (0.25 percent by volume) and a drift control agent (0.07 percent by volume) should be added to the mixture. For optimum plant control, an aerial application should leave the entire Russian olive canopy glistening with spray liquid long after spraying has occurred. This can partially be accomplished by equipping the aircraft with the correct spray system and by spraying under optimal environmental conditions. Moderate temperatures (60 to 80 °F), high relative humidity (65 to 90%), and light winds (3 to 7 mph) are ideal to maximize herbicide activity. Late summer (August–September) is usually the best time to spray Russian olive by aircraft. Plants to be sprayed should be in a healthy state with full foliage that has not been stressed by drought, damaged by hail, or is beginning to turn yellow late in the season.

Basal bark method – IPT basal bark treatments are most effective on Russian olive that has a stem diameter of 5 inches or less. Apply a solution of 25 to 50 percent triclopyr combined with carrier oil using a low volume, hand-held sprayer fitted with an adjustable nozzle (X0 to X1 orifice size) to deliver a mist spray. Spray around the entire circumference of the stem between ground level and 12 to 15 inches up the stem until bark is wet but not running off. The basal bark method can be used any time of year but is often done in winter when surrounding plants are dormant and impacts to non-target plant species can be minimized. Adding a dye to the chemical solution will aid in determining continuous and adequate coverage. Leave treated trees in place following spraying.

Cut-surface methods – There are several different cut-surface methods that can be used to treat Russian olive, especially when it is interspersed with sensitive, non-target plants. These include –

- **Basal cut-stump with herbicide** – This method allows specific trees to be immediately removed and can be used any time of year except under freezing conditions. Cut the trunk as close to the ground as possible and apply the herbicide solution to the cut surface using a paint brush, wick applicator, or a low volume hand-held or backpack sprayer. The cut surface should be horizontal to the ground to minimize runoff, and any residual sawdust over the cut surface should be removed prior to herbicide application. A solution of triclopyr ester or imazapyr mixed with bark or crop oil must be immediately applied within 15 minutes. The herbicide:oil mixture ratio can vary from 33:67 to 50:50 v/v depending on the number and size of plants to be

treated and the application technique used. Lower ratios (e.g., 33:67) are typically used when applications are made with a low volume backpack sprayer or hand-held spray bottle, whereas higher ratios (e.g., 50:50) are used when the solution is brushed directly onto the cut stump. Cut surfaces of plants with less than 4 inches diameter must be thoroughly wetted with herbicide to kill the roots; however, the herbicide should be applied to the cambial layer just inside the bark ring if the diameter of the Russian olive stump exceeds 4 inches. A blue indicator dye should be added to the spray mixture to show prior treatment of stumps. Disposal of trunks, limbs, and other top growth should follow acceptable practices (e.g., stack piles or mulch debris).

- **Cut surface with herbicide –** A chain saw is used in late fall or winter to cut Russian olive with stem diameters of 4 inches or greater. Triclopyr is then immediately applied to the cut surface within 5 minutes of cutting each tree. For stems < 8 inches in diameter, a 50 percent solution with carrier oil can be used. A 75 to 100 percent solution should be used for stems > 8 inches in diameter.
- **Girdling with herbicide –** Use an ax, saw or chain saw to make two horizontal cuts through the bark and cambial tissue around the entire trunk; cuts should be 3 to 4 inches apart. Using a blunt object (such as the ax head), knock off the bark between the cuts. Spray or paint the cut surface of the girdled area with a 50 to 100 percent concentration of chemical herbicide (such as imazapyr or triclopyr) until the cut surface is thoroughly wet. During the summer, the most effective time to girdle and apply chemical treatment is when Russian olive is fully leafed-out and actively growing. Leave tree in place for 2 to 3 years following treatment.
- **Hack-and-squirt (injection) –** This method is not recommended for trees with trunk diameters less than 2 inches. A number of specialized tools are available for this method, including the Hypo-hatchet® and tree injector. However, a simple hatchet and quart-sized spray bottle can also be used. Make a circle of unconnected, non-overlapping, downward-angled cuts (each cut 2 inches wide) into the sapwood; allow 1 to 2 inches of uncut bark between each cut. On average, there will be one hack/cut per each inch of diameter plus one extra cut. Place a small amount of herbicide in each cut as it is made. Each herbicide label will specify the exact quantity of chemical to use within each cut. Generally, 1 to 2 squirts from a quart or pint trigger spray bottle will be equivalent to 1 to 2 milliliters (1/4–1/2 teaspoon). Apply herbicide so cut is wet, but herbicide is not running out. Triclopyr, imazapyr, glyphosate, and 2,4-D with picloram can be used for injection methods.
- **Frilling with herbicide –** Similar in approach to hack-and-squirt; however, cuts are connected and slightly overlapping with the bark still attached at the base of the cut to make a frill.

Integrated Control Methods

Numerous integrated approaches—each with varying success—have been developed to manage well-established Russian olive. Successful long-term management (typically more than 5 years) usually includes a combination of mechanical and chemical methods of control, which possibly can be combined with prescribed fire or goat grazing. A combination of control methods is particularly useful to achieve long-term stability of native plants.

Management Strategies

Small infestations on otherwise healthy sites should be treated early, and the goal should be to remove all trees. Strategies used for control and restoration on large sites infested with Russian olive must involve careful planning. Control strategies for Russian olive within a watershed or a particular drainage may vary depending on management objectives and location. For example, eradication or reduction of Russian olive in headwaters or upstream areas may help prevent the spread of the tree along waterways downstream. In transitional zones such as river edges or riparian areas, Russian olive may be removed to improve natural flooding regimes. In depositional or flood plain areas, goals for Russian olive may include enhancing

wildlife habitat, regenerating native riparian communities, or meeting other multiple-use needs.

Since Russian olive can develop new roots from adventitious buds that come in contact with soil, it is important to remove as much of the plant material as possible. All root and stem remnants should be removed or piled and then destroyed by using fire, shredding, or mulching. Once cut down, dead debris can be gathered and piled for burning at a later time under safe conditions. As an alternative, debris may be mulched by using a mobile, high horsepower tractor that has a high-speed, rotating drum equipped with cutting teeth. A tractor equipped with a flail-type mower attachment can be used to mow smaller diameter stems and debris that remain.

After Russian olive trees have been removed, the cleared area should be closely evaluated to determine the best follow-up strategy for control of re-sprouts. In situations where Russian olive re-sprouting is low or moderate, a team approach to foliar spray regrowth may be effective. Goats may be used in certain areas in a controlled, intensive grazing approach on seedlings and re-sprouts for a limited time during the spring. Fencing may be necessary to confine goats to areas of infestation. Another follow-up option is to perform a prescribed burn on regrowth using a high heat fire in the late summer to early fall. Monitor for return of Russian olive and spot spray new plants.

Vigorous revegetation is often required once Russian olive has been removed. Without special management, treated areas may rapidly be reinvaded by Russian olive or other invasive species. Always consider the need for seeding or replanting desirable plants before initiating any Russian olive control activities. Managers should understand the revegetation requirements of a site after treatment and include restoration as part of a control strategy. Sustainable control over the long term is best accomplished by planting competitive native plants that have a high exclusionary capability.

Regardless of the initial strategy used, the key to long-term Russian olive control is to conduct monitoring and follow-up treatments for re-sprouts and seedlings. Russian olive management requires a long-term commitment that will likely take 3 or more consecutive years of treatment followed by 1 to 2 years of monitoring for regrowth. Since it is ordinarily useless to treat an area only one time without retreatment, it is especially important to match resources to the area where Russian olive control is attempted. Only an area that can be retreated successfully should receive initial treatment so that resources are available to re-spray or re-treat as necessary. Failure to perform follow-up management may result in a return of the infestation.

Adaptive Management

It is important to establish realistic goals and objectives in managing Russian olive, especially when infestations are widely spread. 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 is 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