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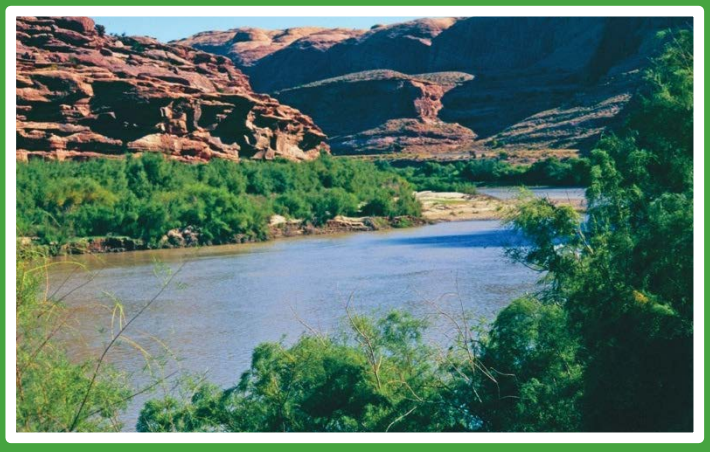
Field Guide for Managing Saltcedar in the Southwest



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Saltcedar (*Tamarix* spp.)

Tamarisk family (Tamaricaceae)

Saltcedar is an invasive plant common to southwestern States and has been listed in New Mexico as a noxious weed. This field guide serves as the U.S. Forest Service's recommendations for management of saltcedar 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

Saltcedar (synonyms: salt cedar, salt-cedar, tamarix, tamarisk) is an invasive plant in the Tamaricaceae that worldwide includes 54 species in 4 genera. Saltcedar taxonomy is somewhat disputed, and scientific writers use nomenclatures that are different from each other. Saltcedar and tamarix have been applied as common names for many species in the *Tamarix* genus; however, these terms in the southwestern United States usually refer to *T. chinensis* or *T. ramosissima*. Although these species can hybridize, many taxonomists consider them to be the same species since they are indistinguishable from one another; in which case, *T. chinensis* is the more appropriate taxonomic name.

Growth Characteristics

- Perennial, deciduous, small shrub or tree, 5 to 25 feet tall; shade intolerant.
- Rooting system consisting of a root crown; shallow, lateral rhizomes; and deep roots that can penetrate to a depth of 30 feet or more.
- Small, scaly, bluish-green, flat leaves resemble evergreen "needles."
- Reddish-brown branches; smooth, slender, and flexible but snap off easily; bark furrowed and ridged with age.
- Flowers March through October; many tiny, pink-to-white flowers with five petals.
- Extremely small, short-lived seeds resembling pepper; seed tips with tufts of hair that aid in wind and animal dispersal.
- Reproduces by seed and sprouting which commonly occurs from disturbed root crowns or from stems or roots lying near the soil surface.

Ecology

Impacts/Threats

Saltcedar alters the ecology and hydrology of native riparian systems and generally diminishes habitat quality; however, saltcedar can provide nesting sites for birds and may be an important pollen source for honeybees. Leaf drop from saltcedar increases soil salinity and lessens microbial activity. Evapotranspiration rates for saltcedar can be higher than for some native riparian species which may reduce stream flows. Soils become drier under dense saltcedar stands. However, the presence of several defoliating leaf beetle species (*Diorhabda* spp.) may mitigate saltcedar impacts (see the "Biological Control" segment below).

Site/Distribution

Saltcedar is common along disturbed and undisturbed streams, riverbanks, desert springs, flood plains, drainages, and irrigation waterways. It is found throughout most of the United States except for parts of New England, Middle Atlantic States, and the Midwest.

Spread

Rapid colonization and expansion of saltcedar most commonly occurs with flood events or water inundation. Seeds float on water and require damp soil moisture for germination and seedling survival.

Invasive Features

Saltcedar can reproduce by both seed and sprouting. The saltcedar root system is dominated by a root crown that lies 12 to 18 inches below the soil surface. Buds on the root crown and shallow lateral roots will sprout new stems rapidly when aerial portions of the plant are removed.

Management

Saltcedar is difficult to eradicate completely; thus, a saltcedar control program should be based on the degree of control necessary to achieve management objectives. Control and restoration of saltcedar infested areas over the long term typically requires an integrated management approach that involves more than one control method. Although aboveground control methods (fire, mowing, grazing with goats or other livestock, herbicides, etc.) will suppress saltcedar, they will not kill the plant absent the complete destruction of the root crown. Therefore, control methods that target and destroy the root system are the only techniques that provide adequate control of saltcedar. These methods are based either on individual plant treatment (IPT) or stand treatment.

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

- Maintain healthy plant communities to prevent or limit saltcedar infestations. This may involve using improved grazing management to prevent excessive grazing and reseeding areas with desirable grasses and forbs after disturbance.
- Eradicate new populations of saltcedar as early as possible. Combine mechanical, cultural, biological, and chemical methods for most effective saltcedar control.
- Implement a monitoring and follow-up treatment plan for missed plants and seedlings.
- Detect, report, and map large infestations. Keep annual records of reported infestations.

Table 1 summarizes some management options for common situations involving saltcedar. Further details on these management options are explained below. Choice of control method(s) depends on many local factors including the extent and density of saltcedar infestation, current land use, and site conditions (terrain, accessibility, microclimate, presence of flora and fauna, etc.). In particular, the presence and potential impact of *Diorhabda* leaf beetles on saltcedar should also be evaluated. Other important considerations include treatment effectiveness, overall cost, and amount of time needed to achieve control. More than one control method may be needed for a particular site.

Special Considerations

Saltcedar 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 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 saltcedar 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 saltcedar site prior to treatment if the nesting status of the site is undetermined.

Within occupied or suitable flycatcher habitat, saltcedar treatment operations (including ground or aerial herbicide spraying) should not occur during the flycatcher nesting period of April 15 to August 30. When flycatcher nesting habitat 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 saltcedar from April through August, and saltcedar treatment during this period should be avoided if possible.

Physical Control

Manual Methods

Digging or hoeing can be used for individual plants in small areas. Some commercially available hand tools can be used for uprooting small saltcedar plants; however, a shovel or hoe is most commonly used. The root crown and associated layered roots must be entirely removed from the soil. Uprooted material should be stacked into piles and dried before burning or mulching.

Mechanical Methods

Mechanical methods to treat saltcedar range in scale from individual plant excavation (from hand-operated equipment to excavators) to broad-scale clearing (from tillers to bulldozers). Clearing saltcedar stands with a mechanical method often requires repeated applications.

Table 1. Management options*

Site	Site Factor	Physical Control	Cultural Control	Biological Control	Chemical Control
Streambanks or narrow riparian corridors	Accessibility may be limited.	Excavation, grubbing	NA	Grazing with goats.	Cut stump method, individual plant treatment (IPT) foliage spray, aerial application of herbicide by helicopter.
Flood plains, valley bottoms, or other flat areas	Emergent saltcedar seedlings on tillable land.	Shallow disking	Prolonged flooding	Same as above.	Low volume broadcast spray.
	Sparse to moderate stands of young saltcedar or regrowth.	Excavation, grubbing	NA	Same as above.	IPT or broadcast foliage spray.
	Open saltcedar stands; goal is to suppress.	Mowing, shredding, mulching, scraping, prescribed burning.	NA	Same as above.	Sub-lethal herbicide application that defoliates but does not kill the tree. To prevent developing herbicide resistance, avoid repeated applications with the same herbicide.
	Open saltcedar stands; goal is to eradicate or provide high mortality.	Excavation, grubbing, root plowing/raking.	NA	Same as above.	Targeted application with a lethal herbicide. Methods include cut-stump, foliage spray, and aerial herbicide application.
	Old saltcedar growth in dense, uniform stands.	Large-scale clearing with root plowing/raking.	NA	Same as above.	Aerial herbicide application by helicopter or fixed-wing aircraft.
Wilderness and other natural or protected areas	Use of mechanical equipment may be restricted.	Hand removal or selective mechanical removal if allowed.	NA	Same as above.	Cut stump method, IPT foliage spray, aerial herbicide application if allowed.

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

Grubbing with a tractor-mounted implement is particularly useful for control of scattered individual trees. A grubbing tool mounted on a tractor's hydraulic system drives a blade into the soil to sever roots below the root crown and force the root crown onto the surface. To prevent re-rooting, grubbed saltcedar should be piled, dried, and then burned or mulched rather than left on the surface.

Excavating can be used to remove individual trees selectively. Operators of excavating equipment must be skilled in placing the extracting bucket beneath the root crown of the target plant and grasping the tree with an opposing hydraulic arm so that it can be pulled directly upward in a vertical motion. Extracting the tree vertically rather than sideways minimizes excessive breakage of the root material at or near the ground surface.

Mulching and excavating can be used in combination by first eliminating top growth of saltcedar through mulching and then using excavation to destroy the remaining root system. Mulching by itself may be used to reduce fuel loading for fires by clearing significant acreage of saltcedar in a relatively short period of time. Mulching requires mobile, high horsepower machinery to operate a high speed rotating drum equipped with cutting teeth. The mulching equipment shreds saltcedar top growth to ground level and simultaneously grinds it into fine segments. Mulching operations leave the roots intact; therefore, saltcedar will re-sprout when growth conditions become favorable. The sprouts will typically reach 2 to 5 feet in height within the first or second season after mulching. A track-mounted excavator may be used to remove the remaining live root crowns and layered roots as indicated by re-sprouting.

Root plowing and raking is a combined mechanical treatment designed to clear large, mature saltcedar stands on relatively level areas. A two-phase approach is generally followed. In the first phase, aerial trunks and stems are cut at the soil surface and piled using a D-7 or D-8 class bulldozer equipped with a front mounted brush blade. An articulated loader equipped with a brush rake working in tandem with a bulldozer may be used to facilitate piling. Piles should be allowed to dry for a month or longer prior to burning. The work may be accomplished during winter months to avoid overheating of equipment and summer nesting of birds. The second phase of control should occur during hot and dry summer months (usually May and June) when root material will dry out after removal from the soil. A 12-foot wide root plow pulled by a bulldozer (e.g., D-7 class) can be used to sever the root crown from the remaining root system about 12 to 18 inches below the soil surface depending on the maturity of the saltcedar stand. Root material near the soil surface can then be raked by a bulldozer (e.g., D-8 class) equipped with a 21-foot wide hydraulic root rake containing teeth that are 4 feet in length and are spaced 15 inches apart. The material can then be windrowed and piled using an articulated loader. The piles are subsequently burned.

Prescribed Fire

Prescribed fire as a single control method is not recommended for long-term saltcedar management since saltcedar is fire-adapted and regrows rapidly. Natural or prescribed fires in mature or decadent stands of saltcedar are hazardous as flame lengths in these fires can be extremely high and crown fires can be difficult to stop with standard firefighting methods. However, burning may be useful or necessary to remove brush piles or any dead saltcedar left standing after herbicide spraying.

Cultural Control

Education and monitoring can be important components to saltcedar control. Some nurseries still stock saltcedar as a decorative plant which could serve as sources of escaped stock in non-invaded areas.

Biological Control

Grazing

Livestock will browse saltcedar, but the foliage has little nutritional value and is usually not preferred. Grazing with goats may be used to suppress re-sprouting after other treatments have been made.

Classical Biological Control

In the early 2000s, the Mediterranean tamarisk beetle (*Diorhabda elongata*) and several allied *Diorhabda* species were released in the southwestern U.S. as host-specific biocontrol agents for saltcedar. Both adult beetles and larvae consume the foliage of saltcedar, which can injure or kill the plant over several years. Individual *Diorhabda* species have different biotic requirements for climate and day length that limit their range.

Two weevil species, *Coniatus splendidulus* and *C. tamarisci*, also feed on saltcedar. *C. splendidulus* became established across the southwestern U.S. after its 2006 release in Arizona, although this release was never approved (or even considered). *C. tamarisci* was approved for release but has not gotten past the cage-testing phase.

Tamarisk beetle expansion from the original release sites threatens to impact the endangered southwestern willow flycatcher, which nests in saltcedar-dominated areas that have replaced native willow communities. Species of *Diorhabda* beetles have moved into Arizona and New Mexico from nearby States, and this advancing migration could impair flycatcher nesting habitat.

Although APHIS suspended further releases of *Diorhabda* species for a time shortly after their initial release, the agency has since delegated responsibility for beetle release to the States. A State's Dept. of Agriculture can approve a release within the State if certain conditions are met (e.g., no release within 200 miles of a known willow flycatcher nest). Therefore, the State's Dept. of Agriculture should be consulted for any regulations relating to release or movement of *Diorhabda* beetles within the State.

Chemical Control

Herbicides are a primary method of saltcedar control and can be applied in a number of ways including helicopter

and fixed-wing aircraft, tractor, truck or ATV-mounted boom sprayers, power sprayers, backpack sprayers, and carpet rollers. Any equipment used to spray herbicide should be calibrated. Treatment success depends on care taken during herbicide application. Most compounds available for saltcedar control (see table 2) have post-emergence activity and provide limited pre-emergence control. Aquatically approved herbicide formulations and surfactants must be used in or near water.

Herbicide Application

IPT basal bark treatment can be made on individual saltcedar plants by using herbicide mixed with oil in a backpack sprayer that is fitted with an adjustable nozzle (X0 to X1 orifice size) to deliver a mist spray from the base of the stem up to 6 inches above the ground. Triclopyr ester herbicide mixed with crop oil in a 50:50 v/v (volume to volume) ratio is an effective mixture. Imazapyr with crop oil may also be used for this application. Although basal bark treatment provides fair control, it is very tedious and time consuming, especially when the saltcedar is multi-stemmed. Applications on older stems with thick, furrowed bark should be avoided since success may be limited. Basal bark treatments are more easily made in winter when foliage is shed; however, summer treatment is recommended in Texas.

IPT cut stump treatment is often used in areas where mechanical treatments or foliar applied herbicide spraying are restricted due to logistical considerations or when there is a need to be highly selective and protect non-target vegetation. The treatment involves hand cutting or chain sawing the saltcedar trunk or stems as close to the ground surface as reasonable, and then applying herbicide to the cut stump surface by paintbrush, hand-held spray bottle, 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 applied immediately 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 saltcedar 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 chips).

Mortality rates from cut-stump treatments are directly related to care taken when treating cut surfaces. Control can be 60 to 80 percent under optimal conditions, but plant kills may be less than 40 percent due to difficulties associated with this method. Therefore, anticipate using follow-up treatment with ground-based foliar applications.

IPT foliar spray may be used to control small saltcedar plants that are less than 5 feet in height and are relatively small in acreage. Saltcedar foliage should be completely covered, and the terminal ends of all branches (including blooms) should be wetted without allowing dripping to occur. The interior of the plant should then be laced with the spray solution to complete the treatment. Ground application of 1 percent imazapyr solution by volume to saltcedar foliage can be made with a variety of spraying equipment such as hand-held pump-up or backpack sprayers, tractor-towed tank sprayers, or ATV-mounted low and high powered sprayer systems. An adjustable cone nozzle (X6 to X8 orifice size) can be used to deliver a coarse spray (large droplets). A nonionic surfactant (0.25 percent by volume) and a blue indicator spray dye should be added to the mixture. Since absorption of herbicide into the foliage is relatively slow, chemical penetration into the plant should be increased by spraying during weather conditions of low wind, high relative humidity, and low air temperature. After treatment, the top growth should remain undisturbed for at least 2 years. Although plants may appear dead (i.e., completely defoliated) in the first growing season after spraying, they will still try to grow. If top growth is removed too early after spraying, saltcedar will shift stored carbohydrate reserves toward apical root buds and will re-sprout.

Table 2. Herbicide recommendations

Common Chemical Name (active ingredient)	Product Example[1]	Broadcast Treatment (rate per acre)	Individual Plant Treatment (spray solution)[2]	Time of Application	Remarks
Triclopyr ester	Garlon 4, Remedy, Ultra, [others available]	NA	50:50 mixture of triclopyr and crop oil with a blue indicator dye.	Anytime	For cut stump treatment, apply to fresh cut stump within 15 minutes of cutting.
Imazapyr	Arsenal, Habitat, [others available]	2 quarts	1 percent mixture for foliage spray (1 gallon per 100 gallons of water with 0.25 percent surfactant and a blue indicator dye).	Late summer to early fall when plants are taking up nutrients; plants should be healthy and not stressed.	For IPT, spray to wet all foliage especially the terminal ends of branches. For aerial broadcast spraying, add 0.25% nonionic surfactant. Use a high spray volume; 15 gallons per acre total solution when applied by helicopter. Allow two full growing seasons before follow-up treatment. This herbicide is a non-selective amino acid inhibitor and will kill desirable vegetation. In addition to spray drift, nontarget 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 quarts + 1.5 quarts	1/2 to 1 gallon + 1/2 to 1 gallon (1–2 pounds + 2–4 pounds per 100 gallons of water with 0.25 percent surfactant and a blue indicator dye).	Same as imazapyr	Both herbicides are non-selective amino acid inhibitors and will kill desirable vegetation through spray drift. In addition, imazapyr may also kill or injure non-target plants through runoff, residue movement in soil, or root exudates from treated plants.

[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 saltcedar.

[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.

Airplanes or helicopters can be used to spray saltcedar successfully if the aircraft is equipped with the proper spray system. Helicopters can spray difficult, "tight" areas that require precision application such as edges of meandering rivers or saltcedar stands interspersed with non-target vegetation. Fixed-wing aircraft are better for spraying large, monotypic blocks of saltcedar where an overlapping spray pattern can be delivered at a lower cost than by a helicopter. Aircraft should be equipped with a satellite guidance system, a variable rate flow meter, 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 pre-programmed to apply herbicide only on defined treatment areas. Swaths should be overlapped to prevent streaking whereby plants are left untreated or slightly damaged.

For aerial applications, 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 quarts imazapyr plus 1.5 quarts 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 saltcedar 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 percent), and light winds (3 to 7 mph) are ideal to maximize herbicide activity. Late summer (August–September) is usually the best time to spray saltcedar by aircraft. Plants to be sprayed should be in a healthy state with full foliage that has not been stressed by drought, hail damaged, or beginning to turn yellow late in the season.

Integrated Control Methods

Aside from beetle defoliations, successful long-term control for saltcedar ordinarily includes a combination of mechanical, fire, and chemical control methods. A combination of control methods is particularly necessary if the primary objective is to achieve long-term native plant stability. For example, a **herbicide**–**burn**–**mechanical** treatment sequence is a practical approach for controlling large, monotypic tracts of saltcedar on valley bottoms and floodplains. The initial step is to apply herbicide aerially, which typically provides 70 to 90 percent saltcedar mortality. After 2 years, prescribed burning is used to remove dead aerial trunks and stems. When prescribed burning cannot be done, mechanical treatments such as chaining, cabling, bulldozing, or roller chopping may be used to drop standing dead debris. Surviving saltcedar plants can then be removed in the fourth or fifth year after spraying with an excavator, grubber, or root plow and raking. In some instances, IPT foliage spraying may be needed to control saltcedar re-sprouting.

Management Strategies

Consideration should be given to the ongoing expansion of *Diorhabda* beetles before implementing saltcedar control projects in Arizona or New Mexico. In some cases, beetle defoliations repeated over time may provide adequate control for specific land management objectives. Timing control projects in conjunction with beetle defoliations may also be useful. For example, it may be advantageous to apply herbicide after beetle defoliation has weakened the saltcedar. However, herbicide application may also delay return of beetles to defoliated saltcedar stands.

In the absence of beetle expansions, saltcedar may be managed to enhance downstream water flow, recreation, fire prevention, grazing, flood control, and aesthetics. Saltcedar control strategies will vary depending on management objectives and location within a watershed. For example, eradication or reduction of saltcedar in headwaters or upstream areas may help prevent the spread of saltcedar along waterways downstream. In transitional zones such as river edges or riparian areas, saltcedar may be removed to enhance water flow and channel characteristics. In depositional or flood plain areas, goals for saltcedar control can vary widely and may include enhancing wildlife habitat, minimizing potential fire hazard, regenerating native riparian communities, or meeting other multiple use needs.

Costs for saltcedar control and revegetation are expensive, and careful selection of areas with a high potential for re-establishment is necessary to provide sustainable saltcedar control in the long term. In some situations, a treated area will recover naturally after aerial spraying without revegetation. In other situations, artificial plantings or seeding may be necessary. Sites that have dense saltcedar stands, poor hydrologic integrity, elevated salinity, or related conditions may have limited revegetation potential. A soil survey may be used to determine the soil texture, ground water depth, salinity levels, and other related soil factors that can ultimately influence replacement of the vegetation community.

Once saltcedar has been removed by conventional physical or chemical treatment, aggressive revegetation is often required. Areas of saltcedar that have been defoliated by *Diorhabda* beetles may also require restoration to prevent establishment of invasive plants. Managers should understand revegetation requirements of a site after conventional treatment and include restoration as part of an overall management strategy. Without planning and care, treated areas may rapidly be reinvaded by saltcedar or other invasive species. In such instances, sustainable control over the long term is best accomplished by planting competitive native plants that have a high exclusionary ability. Native riparian woody species such as cottonwood (*Populus deltoides*), Goodding's willow (*Salix gooddingii*), and coyote willow (*S. exigua*) have a rapid growth potential under conditions of low environmental

stress and are good candidate species for plantings.

Typically, 5 or more years of consecutive field treatments will be necessary for conventional methods to eliminate or substantially reduce saltcedar and its seedbanks. Since it is ordinarily useless to treat an area only one time without re-treatment, it is especially important to match resources to the area where saltcedar control is attempted. Only an area that can be retreated successfully should receive initial treatment so that resources are available to respray or retreat as necessary. Previously treated areas should be monitored continuously to control recovering saltcedar.

Adaptive Management

It is important to establish realistic goals and objectives in managing saltcedar, especially when infestations are widespread throughout a watershed. 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 about calibrating spray equipment:

NMSU Coop. Ext. Serv. Guide #A-613 Sprayer Calibration. Available at: http://aces.nmsu.edu/pubs/_a/A-613.pdf

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