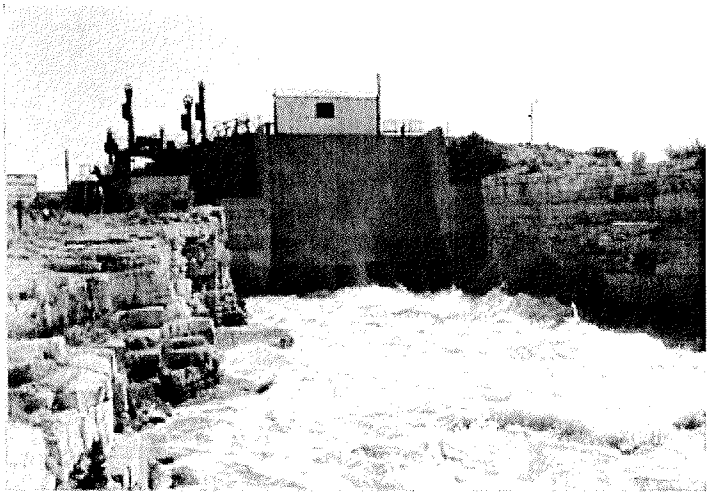
Avalon Dam was originally built in the early 1890s and then reconstructed by Reclamation in 1907 after being destroyed twice by floodwaters. The dam's height was increased in 1912 and again in 1936 Avalon Reservoir is located in Eddy County and has a structural height of 58 feet and a volume of 202,000 cubic yards with a water surface area of 930 acres when full. In addition to being both a storage and regulating reservoir, Avalon Dam serves as the diversion dam for the project by diverting water in to the Main Canal to irrigate project lands on both sides of the Pecos River near Carlsbad. Total reservoir capacity today is 4,980 AF at maximum water surface elevation at 3177 feet (Reclamation datum). The dam is located on the Pecos River five miles north of Carlsbad, NM. Carlsbad Irrigation District operates and maintains Avalon Dam for irrigation releases.



Avalon Canal Outlet Works

Chapter 2. Proposed Action and Alternative

Alternatives considered in this draft EA/BA are the Proposed Action and the No Action alternative (Table 1). The Proposed Action consists of implementing the Vegetation Management Program in addition to ongoing operation and maintenance activities (O&M). The No Action consists of continuing ongoing O&M.

Table 1. Summary Comparison of the Alternatives

NO ACTION	PROPOSED ACTION
Vegetation Treatments: Ongoing periodic mowing of kochia in the floodway/ root plowing, grubbing and a rubber tire tractor use are used on saltcedar on the shoreline areas of Brantley and Avalon Reservoirs	**Vegetation Treatments:** Possible aerial herbicide treatments of monotypic saltcedar stands; Ongoing periodic mowing of noxious and invasive weeds in the floodway/root plowing, grubbing and use of a tractor on saltcedar on the shoreline areas of Brantley and Avalon Reservoirs; treatments of noxious weeds and kochia possible.
Investigations: None	**Investigations:** Biological, mechanical, and herbicide treatment studies; herbicide residue study; revegetation studies.

Partnering agencies: Carlsbad Irrigation District	**Partnering agencies:** Carlsbad Irrigation District; Carlsbad Soil and Water Conservation District; and New Mexico Department of Game & Fish

No Action

Under this alternative, Carlsbad Irrigation District on behalf of Reclamation would continue to perform O&M activities within the Carlsbad Project. CID manages vegetation in the "floodway", an approximately 6-mile long by 200-300 feet wide strip which is mechanically mowed 1-2 times per year to assure passage of flood flows if and when that type of flood event occurs. The frequency of mowing depends on the rate of vegetation growth and the availability of resources to conduct the work. CID also manages vegetation invading the areas around Brantley and Avalon Reservoirs. Using tractors pulling root plows or rake attachments, stands of saltcedar are cleared and placed in piles. The piles of dead and dried saltcedar are burned once all required burn permits are in place. In addition, CID is considering implementing some chemical treatments of plants invading sites which do not lend themselves to mechanical treatments. The length of Brantley Dam, for example, may be a candidate for chemical application. Current budget limitations have made it increasingly difficult to treat the areas in a timely manner. For those areas not currently being treated, saltcedar would be allowed to grow unimpeded. As evidenced on non-managed areas, the desirable vegetation would decrease as a result of shading, accumulation of litter or "duff", increasing soil salinity, and potentially decreasing water availability through the lowering of water tables. Under this alternative, a Vegetation Management Program proposed by Reclamation would not be implemented. There would be no biological treatments and no aerial application of herbicides and no attempts at revegetation. No research or studies of vegetation management would be proposed.

Under this alternative, there would continue to be independent ongoing efforts in the surrounding landscape targeting control of saltcedar. These are briefly described below.

Pecos River Basin Water Salvage Project

The Pecos River Basin Water Salvage Project is the largest effort to date for removing saltcedar in the Pecos River Basin. It is a federally approved agreement between the states of New Mexico and Texas, Congress authorized the Secretary of the Interior to carry out a continuing program to reduce the nonbeneficial consumptive use of water in the Pecos River Basin, including removal of *Tamarix* (saltcedar) and other undesirable invasive species between the headwaters of the Pecos River and Girvin, Texas. This Project is outside the bounds of and distinct from the Carlsbad Project. The Pecos River Basin Water Salvage Project involves mechanical control only. The project originally encompassed 590 miles and over 200,000 acres within the Pecos River Basin. Of the Pecos River Basin area, approximately 33,230 acres in New Mexico, and 14,000 acres between the State Line of New Mexico, and Girvin, Texas, received saltcedar removal treatment. The process was stopped in 1973 as a result of a lawsuit filed by Central New Mexico Audubon Society, New Mexico Wildlife Federation and others seeking an injunction on further work stating that Reclamation failed to comply with and satisfy the requirements of the National Environmental Policy Act (Civil Action No. 10118, United States District Court). The lawsuit was eventually dismissed in June 1979 after Reclamation had

completed and filed a Final Environmental Impact Statement (FEIS). While no additional lands have been cleared under the program since then, maintenance on those cleared areas continues today. (Brantley and Avalon Reservoirs RMP Project Final EA, Oct 2003).

Currently, Reclamation is maintaining the 33,000+ acres originally cleared in New Mexico, and the State of Texas has withdrawn from the program. Under contract RO910, with Carlsbad Irrigation District, these areas are still being mechanically cleared of any new salt cedar growth, utilizing Reclamation equipment, and labor being furnished by CID. These acreages are scattered on both sides of the river, from Santa Rosa, New Mexico, to the State line of Texas, with about 40% being south of Carlsbad, 40% being north of Artesia, to just north of Roswell at the N.M. State Game Refuge, and about 20% between Santa Rosa and Ft. Sumner Irrigation District.

Pecos River Saltcedar Control Project
The Pecos River Saltcedar Control Project is part of a special appropriation by the New Mexico State Legislature to fund invasive species vegetation control along the Pecos River by soil and water conservation districts. The Carlsbad Soil and Water Conservation District has overseen aerial herbicide applications by helicopter and ground applications. The aerial treatments were applied by North Star Helicopter in September 2002 and again in September 2003, with the following acres being treated:

County	Acres 2002	Acres 2003	Total Acres
Eddy	2,520	2,551	5,071
Chaves	2,853	883	3,736
DeBaca	2,599	1,548	4,147
Guadalupe	1,146	91	1,237

In addition, ground applications included the following acreages treated in the cut-stump contracts:

- Carlsbad SWCD - 29.8 acres
- Upper Hondo SWCD - 37.1 acres
- Guadalupe SWCD - 29.8 acres

(Carlsbad Soil and Water Conservation District Email, July 29, 2004).

Bitter Lake National Wildlife Refuge Integrated Weed Management Plan
The U.S. Fish and Wildlife Service Bitter Lake National Wildlife Refuge, located about nine miles northeast of Roswell, New Mexico along the Pecos River has an Integrated Weed Management Plan to address saltcedar infestations.

Proposed Action

Under this alternative, Reclamation in consultation with the Carlsbad Irrigation District would implement a Vegetation Management Program consisting of a research component and a treatment component, both targeting the pest saltcedar (*Tamarix* sp.) and other invasive or non-desired plants. The research component includes studies of a biological agents, herbicides, and mechanical methods; revegetation; and herbicide residue. The treatment component includes potential aerial application of an herbicide that would be implemented in cooperation with the

Carlsbad Irrigation District and the Carlsbad Soil and Water Conservation District. Treatments of noxious weeds and other invasives are also considered. More details of each aspect of the Program are provided below. The Vegetation Management Program would further our knowledge of the most appropriate and most effective treatment and revegetation methodologies while simultaneously reducing the amount of acreage currently impacted by invasive plants. The Program is anticipated to be dynamic and ongoing over the next approximately 10 years, adapting to new information, and likely initiating new studies. The long-range view of the Program is a reduction of invasive plants, such as saltcedar, noxious weeds, including kochia, and re-establishment of native vegetation like grasses and shrubs. Though many details and specific activities of the Program are unknown at this time, all future work proposals will be consistent with this long-range view. The Program is proposed to be limited to lands of the Carlsbad Project administered by the Bureau of Reclamation or owned by CID. Reclamation will work closely with CID on the Program. No CID land would be included without concurrence of CID.

Reclamation also proposes to treat undesired vegetation on the upstream and downstream slopes of Brantley and Avalon Dams (see Appendix J) for the following reasons:

1) To allow proper surveillance and inspection of the structures and adjacent areas for seepage, cracking, sinkholes, settlement, deflection, and other signs of distress.
2) To allow adequate access for normal and emergency Operation and Maintenance (O&M) activities.
3) To prevent damage to the structures due to root growth, such as shortened seepage paths through embankments; voids in embankments from decayed roots or toppled trees; expansion of cracks or joints of concrete walls, canal lining, or pipes; and plugging of perforated or open-jointed drainage pipes.
4) To discourage animal/rodent activity (by eliminating their food source and habitat), thereby preventing voids within embankments and possible shortened seepage paths.
5) To allow adequate flow-carrying capability of water conveyance channels (e.g., spillway inlet an outlet channels; open canals, laterals, and drains).

The methods selected to control the unwanted vegetation on the dam's slopes will provide excellent control at a minimal cost. The herbicide applications, suggested within Appendix J, can be done in the fall or early winter when temperatures are more favorable for such work. As much as possible, selective herbicides and selective application methods were the preferred choice to limit affects to desirable plants. "Restricted Use" herbicides, which would require certification, and mobile herbicides (those that could potentially cause water contamination) were not selected for use.

Treatment Component

This component would include aerial application of an herbicide that would be implemented in cooperation with the Carlsbad Irrigation District and the Carlsbad Soil and Water Conservation District (SWCD). Reclamation currently has no funding for this type of work but has entered into a Memorandum of Agreement with the SWCD. Reclamation and CID would identify potential areas to be treated and SWCD would determine whether the treatments would be implemented. A separate agreement would be needed between CID and SWCD for treatment of

any lands owned by CID. Reclamation would use the following criteria for selecting potential treatment locations:

1) Limited to stands of monotypic saltcedar on Carlsbad Project lands
2) Coordinate with Carlsbad Irrigation District on treatment site selection
3) At the reservoir, treatment may occur anywhere except within 50 feet of the wetted perimeter.
4) Avoid or minimize environmental impacts and avoid all impacts to any federally listed species.
5) Limited to flat or gently sloped topography, with the exception of channel banks selected by CID.
6) Limited to locations that can be defined with GPS technology.

McMillan – off-road way just North of Dam tenders house, approximately 65 acres (Proposed treatment site #1)

Total acreage of monotypic saltcedar on Carlsbad Project land around Brantley and Avalon Reservoirs is estimated to be approximately 6,172 acres. Some of this saltcedar appears to be thriving while other stands appear less healthy. These differences may be due to the variation in depth to shallow groundwater throughout the Project area. Thriving saltcedar in areas with less depth to groundwater would likely consume more water than saltcedar in poor condition with greater depths to groundwater. This factor is considered when selecting potential treatment sites. Initially, it is likely that no more than a few hundred acres would be proposed for treatment, although in the long term Reclamation would seek to maximize the acreage treated as long as the treatments are successful and there are no highly controversial or detrimental effects. Aerial treatments would facilitate vegetation management in limited access areas while reducing site disturbances. Treatments would normally be applied in late summer or early fall to maximize effectiveness. All applicable laws and regulations will be adhered to and primary considerations will be given to minimizing impacts to non-target vegetation and/or water quality. Treated sites would be allowed a minimum of two years without additional disturbances to allow for maximum herbicide effectiveness. At least initially, revegetation of treated sites would be limited to passive revegetation. Ultimately the desired objective is to reestablish desirable perennial species to aid in site stability and provide some level of control against invasion by noxious weeds or reinvasion by saltcedar.

Area proposed by CID for spraying, an estimated 160 acres of Reclamation Lands (proposed treatment site 2)

Research Component

This component includes studies of a biological agent, herbicides, and mechanical methods; revegetation; and herbicide residue. The treatment methodologies would be tested individually and in combination to evaluate their effectiveness. Revegetation studies would be conducted to determine effective strategies for rehabilitating and stabilizing treated areas. In addition, any channel banks treated per CID request may be studied for stabilization via revegetation. An herbicide residue study would be a specific investigation of the rate of dissipation and persistence of the herbicide Imazapyr applied aerially.

1) Biological Control Study Using Saltcedar Leaf Beetle

Biological control is intended to target and control exotic, invasive plants in relatively stable ecosystems such as natural areas and rangelands, by the introduction of the natural enemies (insects) that regulate the weed's abundance in its native region. The objective is to permanently reduce the weed's abundance below the damaging level, but not to eradicate the weed. Saltcedar is an "ideal" weed for biological control. It has low beneficial values, lacks closely related plants in the Western Hemisphere, and has a large number of host-specific and damaging insects that attack it within its native distribution (Briefing Paper: Biological control of Saltcedars, DeLoach and Carrauthers, Jan 2004).

Both adults and larvae of the saltcedar leaf beetle feed on the foliage of saltcedar. The large larvae also remove the outer layer of stem tissue causing the distal foliage to die. The adults overwinter and the larvae pupate under litter beneath the trees. Field cage studies showed a range of population increases with a 30-fold increase per generation not uncommon. In Colorado and Wyoming, overwintered adults become active in late April and produced two generations before they began overwintering in September. In the more southern areas, the saltcedar growing season appears to be long enough to allow completion of three or possibly even five generations. (Briefing Paper: Biological control of Saltcedars, DeLoach and Carrauthers, Jan 2004).

Preliminary results indicate the biological program has a high probability of providing good control of saltcedar over much of the infested areas of the United States. The US Department of Agriculture (APHIS) has permitted the controlled release of two species of insects for saltcedar biocontrol. Clearances have been obtained from US Fish and Wildlife Service (Service) for release on the Pecos River.

This study includes the release of the saltcedar leaf beetle for research purposes only. The release site would not exceed ten acres. The environmental clearance for this study has already been obtained and the study was initiated in May. However, it is included in this document to present a more comprehensive assessment.

Beetle population increase outside the cages and damage to saltcedar

Eggs will be used as an indicator life stage because they are immobile, they are easy to see, and they persist for a long time. To estimate the increase in beetle populations from one generation to the next, we will count the number of eggs laid during each generation on sentinel branches that are sampled repeatedly. Sampling will therefore be done once per generation or two to three times per year depending on the length of the growing season. Sampling should be done around the time of peak egg deposition, or about 2 weeks after peak adult emergence. Eggs will be counted on 25 trees that are randomly selected from all saltcedar trees within a 56.4 m radius circle (ca. 1 ha) around the release point. If aerial photographs of the site are available, and the exact beetle release site is known, the sample trees can be pre-selected using the aerial photos. Coordinate tree selection with personnel monitoring vegetation at the site because the vegetation and insect groups will be monitoring some of the same trees. Number each tree and make a photograph of each tree. Repeat photographs should be taken at least each year.

On each of the 25 trees, select four branches (one in each of the N, S, E, and W cardinal directions). Do not select branches on which beetles have been released. If there are fewer than 25 trees within the 56.4 m radius circle, more branches per tree can be selected so that a total of 100 branches are monitored. Trees of different sizes can also be selected. Flag, tag, and/or spray-paint the branch so the branch can be located again (for at least two years). Place a permanent mark on the branch 40 cm from the tip.
At the time of peak egg laying for each generation, collect the following data for each of the 100 branches: 1) length of the branch from the mark to the tip, 2) the number of *Diorhabda* eggs on the branch, 3) the percentage damage of the branch due to *Diorhabda* (0 - none; 1-10% - light; 10-50% - moderate; 51-95% - heavy; and 96-100% - complete), 4) the relative abundance of leafhoppers, 5) the relative abundance of scale insects, and 6) the damage from leafhoppers. As the population of beetle moves outside the 56.4 m radius circle, it may be worthwhile to start sampling the other saltcedar plants already being monitored by the vegetation group.

Dispersal

Both short- and long-range dispersal of the beetles will be monitored. Insects often exhibit two types of movement: trivial and migratory. If these beetles act like other weed biocontrol agents, their populations will build up locally and spread out like ripples on a

pond (trivial dispersal). A small number of females may also migrate some distance away from this general area of infestation and start new populations (migratory dispersal). With many insect species, migratory dispersal does not begin until after a few years when populations have increased to large numbers in the release area. It is desirable to determine the presence, extent, and timing of these types of dispersal behavior for *D. elongata*. The general change in beetle density and distribution near the release site will be determined, and samples will be collected up to 8 km in each cardinal direction away from the release site to look for longer-range dispersal and the initiation of new populations.

Opportunities to integrate the other treatment methodologies and revegetation studies will be implemented as appropriate. Those opportunities will depend on the results and success of the beetles and identifiable research needs.

2) Herbicide Treatment Studies

Reclamation would treat saltcedar with herbicide products currently labeled for use on range and pasture, noncropland or aquatic sites in New Mexico. Developments of successful herbicide treatments and products within the last ten years make possible a reduction in saltcedar densities through plant mortality. The work would be inclusive of foliar broadcast applications, foliar individual plant treatments, carpeted roller treatments, basal bark and cut-stump applications dependant upon plant densities, location to water, presence or absence of other vegetation, and cost effectiveness. The candidate sites for aerial application would be limited to monotypic saltcedar. Aerial treatments would facilitate vegetation management in limited access areas while reducing site disturbances. The proposed work would be conducted to avoid impacts to any federally listed species. All applicable laws and regulations will be adhered to and primary considerations will be given to minimizing impacts to non-target vegetation and/or water quality. Herbicide treatment selection would be based upon location, size, density and physiological condition of saltcedar. Foliar treatments either ground based or aerially applied requires saltcedar to have adequate green foliage to uptake the herbicide and locations where plants are under drought stress will be avoided.

Treated sites would be allowed a minimum of two years without additional disturbances to allow for maximum herbicide effectiveness. Passive revegetation utilizing natural responses would be managed for in most cases. Active revegetation through site preparation, reseeding and additional weed management may be necessary in some areas, e.g., where weedy species, such as kochia, begin to dominate the sites, or in areas devoid of all cover due to saltcedar duff and high salinity. Ultimately the desired objective is to reestablish desirable perennial species to aid in site stability and provide some level of control against invasion by noxious weeds or reinvasion by saltcedar.

3) Mechanical Treatment Studies

Mechanical treatments (mowing on weeds/shredding) that may be employed would involve the use of tractor mounted rotary mowers to cut smaller trees and the use of larger flail head /mulcher type cutters mounted on wheeled and track vehicles for larger

diameter trees. A root plow and grubber are also used in the mechanical treatment for saltcedar (see photos below). Mechanical treatments would occur in combination with 1) biological controls and 2) revegetation site preparation. Work may be located at the McMillan Breach area and would not be expected to exceed 600 acres.

Root Plow used in saltcedar removal.

Grubber used in saltcedar removal.

4) Revegetation Studies

Initially, two 6.2 acre study sites in the existing "floodway" on Reclamation administered Project lands are being considered for establishment. These sites were selected based upon their soil morphology and history. Both sites were previously occupied by dense infestations of saltcedar which were cleared by root plowing over a decade ago. Site selections were made to include one site having a predominant lacustrine (lakebed) soil and the other an alluvial (river deposited) soil more typical of the area. The lakebed site is currently occupied by *Kochia sp.* while the alluvial site is mostly bare ground with some patches of grass. Both sites would be treated with a non-selective herbicide containing the active ingredient glyphosate prior to seedbed preparation and seeding in order to obtain unbiased results.

Revegetation Plot South Site just north of major power line.
CID mows this floodplain 1-2 times annually for Reclamation.

Results obtained from these studies would be used to determine best practices for

revegetation and rehabilitation of treated sites. Additional study sites may be established subject to funds availability and need for further investigations. CID will be consulted for recommendations on additional or preferable study locations. Channel bank locations could possibly be identified for bank stabilization revegetation studies.

Appropriate methods for revegetation will be based upon results from field investigations. Work is expected to be located within the old McMillan lakebed (lacustrine soils) and the other to the north with soils deposited primarily through historic flooding events. A component of each will receive limited irrigation to simulate annual rainfall. The irrigated component will provide moisture to simulate typical monsoon rainfall events and may incorporate rainfall simulation to insure timing and total expected rainfall. Ideally monsoon rains typical for the area will be the norm; however it will be expedient to have irrigated sites to show what is possible in the event that rainfall is below normal.

5) **Herbicide Residue Study** Residual Imazapyr Levels in Soils of Areas Treated in the Pecos River Salt Cedar Control Project

The Pecos River Salt Cedar Control Project was initiated in September of 2002 with the aerial spraying of approximately 9,000 acres of private land situated along the banks of the Pecos River, with the herbicide Imazapyr. Approximately 5,000 acres of private and Bureau of Land Management lands were sprayed in September 2003. Aerial applications for September 2004 are anticipated to include approximately 500 acres (to be updated) of Reclamation land in the proximity of McMillan Delta, approximately 20 miles north of Carlsbad, New Mexico.

Reclamation is attempting to document any residual concentrations of Imazapyr in the areas treated in 2002 to aid in future revegetation efforts. Results from the initial analysis of samples selected for method development yielded only a trace of the herbicide in one of the samples. Four of the samples analyzed were collected from areas sprayed with the herbicide in 2002. One of the samples was from an unsprayed area. The four treated samples were selected for their range in salinity.

Because of the absence of Imazapyr in the initial analysis, samples are currently being examined from two isolated areas suspected of being sprayed with possibly excessive concentrations of the herbicide due to excessive kills of "non-susceptible" plant species. Soil samples from the two suspect areas, recently collected in June 2004, are currently being analyzed (16 samples). Additional samples covering a balanced representation of the total treated area along the Pecos River will be submitted for additional analysis.

Based on preliminary results, there was essentially no residual Imazapyr in the archived soils samples collected 3, 6, 9 and 14 months after application. Imazapyr in archived samples (air-dried samples sealed in plastic bags, and stored in the dark) is believed to be stable, but not definitely known. Two strategies are currently underway or planned to address this stability issue.

First, soil samples collected July 1-2, 2004 from Reclamation land aerially treated with Imazapyr in September 2003, in the vicinity of Elephant Butte Reservoir situated on the Rio Grande will be analyzed. These samples are currently being air-dried and will soon be shipped for laboratory analysis without archiving. This will be one approach to address the effects on the stability of Imazapyr from archiving soil samples. Eight sites were sampled from treated areas and two sites were sampled from non-treated areas. Four depth intervals were collected at each site. Forty samples will be available for analysis; however, the cost of analysis may require that only a subset of these samples be analyzed.

Second, a sampling program will follow the 2004 aerial spraying of Carlsbad Project land described above. Samples will be collected from established sites in treated areas over a period of time, until no residual herbicide can be detected. The sampling of Carlsbad Project land will be initiated at two week intervals, two weeks after herbicide application is completed for three sampling intervals. If significant concentrations of residual Imazapyr are detected after the initial sampling period, sampling will continue at monthly intervals for a period of three months. Should the herbicide persist through this observation period, the sampling period will be adjusted to two-month intervals until no residual herbicide can be detected, or it is concluded that no additional analyses are needed for assessing the persistence of Imazapyr.

Three sites will be established on herbicide-treated Carlsbad Project land (approximately 500 acres (to be updated)) for the duration of the time-interval sampling study. Samples will be collected at depth intervals of 0-3, 3-6, 6-12, and 12-18 inches. This will yield 12 samples from three sites per time interval. The deeper sampling intervals are included to address the possible mobility of the herbicide. (M. Walthall, Ph.D., July 28, 2004 email).

Alternatives Considered but Eliminated From Further Study

Prescribed Burning (Sole treatment)

Burning may effectively suppress saltcedar however it seldom causes mortality. It can be used as a tool for height management in conjunction with herbicide treatments, or to remove standing deadwood and duff. Since burning is nonselective, oftentimes less fire tolerant species such as cottonwoods and willows can be lost or damaged. Fire by itself is not an effective treatment option for established saltcedar.

Livestock Browsing

Livestock, native ungulates and other animals readily browse or eat the bark of native cottonwoods and willows, frequently killing the young plants and bringing reproduction to a halt. However, these animals feed much less on saltcedar, which soon grows taller than the livestock can reach. (USDA, Biological Assessment, September 1997).