

Giant Reed

Arundo donax

Treatment Priority: HIGH

Management Goal: ERADICATION

Species Description

Bamboo-like perennial plant up to 25 ft with thick, well developed scaly rhizomes. The canes are erect, semi-woody and 1-2 inches thick. Young canes are unbranched, while older canes are often branched sometimes with leaves only on the branches. Inflorescences are large and plume-like, can be 1-2 ft tall and silvery cream/purplish/brown in color.



Photo by Sue Carnahan

Occurrence on PCNRPR Open Space Lands

Giant reed can occur in Sonoran desertscrub as well as thornscrub, both xeric and mesic. It is localized to common in natural resource parks and conservation ranches. It is documented along Bear Creek, Tanque Verde Creek, Cienega Creek, and the Santa Cruz River.

Treatment Options

TREATMENT	SEASON	COST CONSIDERATIONS
Cultural		
A flame thrower or weed burner device can be used as a spot treatment to heat-girdle the stems at the base of plants. Its effectiveness is comparable to manual cutting.	During wet periods, not during wildfire season/drought	Less costly than basal and stem herbicide treatments.
Mechanical		
Hand digging can be highly effective, but only appropriate for small stands. The entire root system must be removed, as well as any rhizomes. Plant material should be hauled offsite to limit resprouting potential.	ANY	Very time-consuming, only appropriate for small stands. A good volunteer opportunity for the right group.
Rotary brush cutters, chainsaws and tractor mounted mowers may facilitate initial biomass reduction. However, these treatments should be followed by rhizome removal or chemical applications. The disturbance may also interfere with the establishment of native plants. Mowing may also lead to fragments reestablishing.	ANY	-
Chemical		
Cut-stump (glyphosate): Concentrated glyphosate applied to cut stumps within 1-2 minutes of cutting provides excellent control. Use aquatic formulations when near water sources.	Late Spring - Early Fall	Biomass removal decreases herbicide cost.
Foliar (glyphosate): uptake and kill may be achieved by spray application during active growth periods; small patches can be treated from the ground using backpack or towed sprayers.	Late Spring - Early Fall	-
Foliar (fluazifop OR sethoxydan): Most effective during growing season at a 2-5% solution rate. Not aquatic safe.	Late Spring - Early Fall	-
Foliar (imazapyr): Provides excellent control. Requires and adjuvant when applying postemergence. Imazapyr outcompeted glyphosate in a TX study with high levels of control after 2 years. Use only in solid stands; may travel through soil to affect non-target plants.	Fall	-
Foliar (imazapyr + glyphosate): This combination is thought to provide better control at lower rates of each herbicide.	Fall	Lower rates of application; more affordable than using just one herbicide
Cut then Spray: Cut stalks to remove biomass, and after 3-6 weeks apply foliar treatment using the aforementioned herbicides to the regrowth. In one study, this method was 50% effective in the first year of treatment and 75% effective in the second.	Late Spring - Early Fall	Biomass removal decreases herbicide cost.

Oncosiphon piluliferum

Stinknet (preferred); globe chamomile

Treatment Priority: HIGH

Management Goal: ERADICATION

Species Description

This winter annual (6-24 inches tall) is easily recognized by its dark green “carrot like” leaves and unique rounded yellow flowers. The leaves have a pungent and very distinctive odor; it is not likely to be confused with other plants.

Occurrence on PCNRPR Open Space Lands

Stinknet can occur in Sonoran desertscrub as well as thornscrub, both xeric and mesic. It is localized to common in natural resource parks and conservation ranches. It has been recorded in Arizona between 1,000 ft and 4,200 ft in elevation.

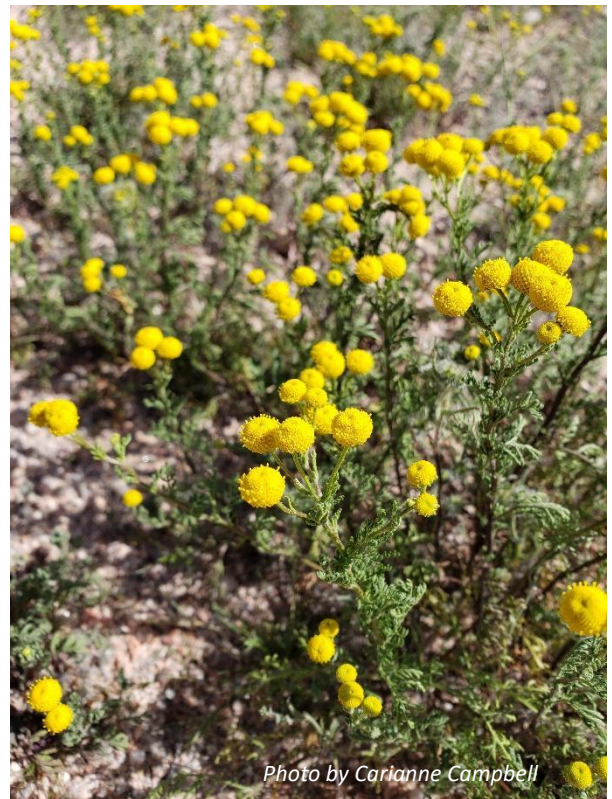


Photo by Carianne Campbell

Treatment Options

This is an emerging threat and there is not a long history of treatment in our region; many trials are ongoing. Unlike many winter annuals, there is a relatively long window for treatment due to the long (≈ 2 months) period between emergence and flower head development. In addition, the plants do not go to seed until all flowers on the head have blossomed. Some personnel may experience sensitivity to the volatile compounds released during treatment.

TREATMENT	SEASON	COST CONSIDERATIONS
Cultural		
Grazing. Ineffective; not palatable to livestock, and can make the problem worse.	N/A	N/A
Mechanical		
Hand-pulling. Stinknet flowers from January to June, and hand removal must be performed before the plants set seed. Do not attempt once seedheads are present. Can be successful for smaller patches. Expect at least 2-3 years of repeated treatments.	Spring	Appropriate for volunteer groups; excellent outreach and education potential.
Mowing or weed whacking. Limited effectiveness because plants resprout and flower closer to the ground. Not recommended.	N/A	N/A
Chemical		
Foliar. Milestone (aminopyralid), Capstone (aminopyralid and triclopyr) and glyphosate are all highly effective at controlling Stinknet, but only before the plants have flowered. Current recommendation is glyphosate with methylated seed oil (MSO) to get through the oily leaves. Best applied to seedlings or small plants.	Spring	-
Preemergent. Preliminary results from a study in California showed that Esplanade, Gallery/Dimension and Milestone were all found to be more effective at reducing Stinknet cover versus postemergent chemicals such as Garlon, Glyphosate and Transline. Preemergent herbicides were applied in November 2018 and postemergent herbicides were applied in April 2018 on separate study plots.	Just prior to late fall / early winter rains; a second application may be needed for later germinating plants	-

Yellow Bluestem

Bothriochloa ischaemum

Treatment Priority: HIGH

Management Goal: ASSET-BASED
PROTECTION

Species Description

Perennial grass that may form low clumps, especially under grazing pressure. Leaf blades contain scattered hairs at the base of the blades. The inflorescence can be fan-shaped or look like feathery fingers with a reddish-purplish hue. May be confused with [native] cane beardgrass (*Bothriochloa barbinodis*).



Occurrence on PCNRPR Open Space Lands

Yellow bluestem can occur in thornscrub and semidesert grassland, both xeric and mesic. It is localized to common in natural resource parks and conservation ranches. It is documented at Bar V Ranch.

Treatment Options

TREATMENT	SEASON	COST
Cultural		
Grazing may be helpful to reduce biomass, but as a standalone treatment, it is not effective.	Graze in the spring when plants are potentially more palatable to reduce biomass, or in fall - winter on standing residue.	Low/no cost on appropriate ranch properties.
Prescribed Fire alone will not control populations. Repeated treatments of prescribed burning + chemical applications + reseeding with native plants may help suppress infestations.	Per recommendations of fire managers.	-
Mechanical		
Mowing. Use late season long term mowing to reduce growth in spring. Due to likelihood of contributing to increasing population density, combine with chemical applications/prescribed burns.	Late Spring. Do not mow once seedheads have started to form.	-
Disking alone is not effective and will increase populations if not followed with herbicide treatment. Disking followed by chemical applications and reseeding efforts may help reduce the infestation.		-
Hand pulling/digging may aid in control, especially in smaller patches. Remove as much of the root stock as possible.	ANY	-
Chemical		
Foliar (glyphosate). An OK study found that multiple applications in a single year, (2-3 times) were effective in reducing presence. This is also true when a single burn or a single mowing session was followed with a single chemical application. Overall, mowing and burning followed by two applications of glyphosate provided 77-98% control.	Summer, when plants are actively growing. Single application - when plants are in boot stage prior to seed production. Split application - during the 5 leaf stage and again 8 weeks later.	-
Foliar (imazapyr). Highly effective in trials conducted post burn. More effective than glyphosate. Native grasses may be more resistant to imazapyr than glyphosate.	Summer, when plants are actively growing. Single application -when plants are in boot stage prior to seed production. Split application - during the 5 leaf stage and again 8 weeks later.	-
Foliar (imazapyr + glyphosate) treatments are more effective than glyphosate alone.	Early spring treatments were more effective than fall applications.	-
Preemergent (Bromacil). Bromacil provided excellent control, almost as good as imazapyr in a study which included a burn prior to treatment.	-	-

Brassica tournefortii

Sahara Mustard

Treatment Priority: HIGH

Management Goal: ASSET-BASED PROTECTION

Species Description

Sahara mustard is a winter annual that can grow up to 4 ft tall, or even more. Basal rosette leaves are lobed, warty and hairy. Lower stems will have stiff, white hairs. Flowers are yellow with four petals. Sahara mustard reproduces solely by seed, and each plant can produce more than 10,000 seeds; treatment prior to seed set is critical for effective control. May be confused with other winter annual mustards such as non-native London rocket (*Sisymbrium irio*) as well as the native wildflower scorpion weed (*Phacelia* spp.); both of these will lack the warty leaves.

Occurrence on PCNRPR Open Space Lands

Sahara mustard can occur in Sonoran desertscrub as well as thornscrub, both xeric and mesic. It is localized to common in natural resource parks and conservation ranches. It is documented along the I-10 / Santa Cruz River Corridor. Prefers sandy soils but can grow in a variety of soil types.

Treatment Strategies

This species has been shown to germinate very aggressively when soils are saturated; very wet winters present an opportunity for effective treatment that severely diminishes or eliminates the seed bank. This circumstance could be recreated at a small scale with irrigation.

Sahara mustard also germinates earlier than most native annuals, creating an opportunity for foliar herbicide control of the early basal rosettes that has low potential to impact non-target annuals. Application prior to germination of other species can be cost effective because personnel can move through an area faster.



Treatment Options

TREATMENT	SEASON	COST CONSIDERATIONS
Cultural		
There is no evidence of efficacy for grazing and mustards can be toxic to goats, sheep, horses and cattle. Although fires cause high seed loss, stem densities reach pre-burn levels within one or two growing seasons. Partial seed survival after fire may be related to its hard seed coat.	N/A	N/A
Spot flaming may be a useful technique for individual plants in low fire risk situations where physical removal is not desired to prevent soil disturbance.	In the winter during a rain event.	-
Mechanical		
Hand pulling can be effective, especially for smaller populations. If plants are mature, it is good practice to remove the plant and bag it to prevent seeds from germinating because green seedpods on pulled plants can continue to develop and produce viable seeds.	Spring	Appropriate for volunteer groups.
Hula hoes early on in development when rosettes are small can be effective.	Winter / Early Spring	
Mowing or weed whacking early on in growth stages (early bolting) can be effective and cut plants can be left onsite without concern for viable seeds entering seedbank.	Winter / Early Spring. These methods will increase Sahara mustard by spreading seeds if done too late.	-
Cultivation alone may stimulate the seedbank and produce more plants. However, if combined with chemical applications, this technique may reduce populations.	Spring, prior to seed set.	Requires follow up herbicide treatment
Chemical		
Foliar (glyphosate). Apply when plants are actively growing, but before flowering. Most effective on smaller plants or used as a follow up treatment.	Winter / Early Spring	Glyphosate is preferred for many other species and would not require purchase of an additional chemical.
Foliar (glyphosate + 2,4 D). Can be applied when seed pods are present as long as they are green. Effectively kills developing seeds.	Winter - Spring	-
Foliar (triclopyr). Very effective. Most effective applied at a 2-5% solution on plants that have very undeveloped seeds up to mid-	Winter - Spring	-
Preemergent or Foliar (imazapic). If foliar, early rosette stage. Provides effective control with residual soil activity. Can be mixed	Winter / Early Spring	-
Foliar (aminopyralid). Add non-ionic surfactant for adverse conditions (high heat, low humidity, dust) or on mature stands.	Spring	-
Aminopyralid + metsulfuron methyl. Granular formulation.	Spring or Fall	-
Clopyralid. May be used in combination with 2,4-D and a non-ionic surfactant. Potential for groundwater contamination.	Spring or Fall	-
Foliar (metsulfuron methyl). Apply in early leaf stage. Add non-ionic surfactant. May be used in combination with 2,4-D. Not for use near	Fall or Winter	-
Preemergent or Foliar (chlorsulfuron). If foliar, early rosette stage. Highly effective with some residual soil activity.	Fall - Early Spring	-
Foliar (dicamba + 2,4-D). Apply during seedling to rosette stage. Do not use near water	Winter / Early Spring	-

Pennisetum ciliare

Buffelgrass

Treatment Priority: HIGH

Management Goal: ASSET-BASED PROTECTION

Species Description

Buffelgrass is a perennial bunchgrass which turns bright green when actively growing and turns a straw color when dormant. During the flowering season, the plants will have a soft purple seed head with a characteristic “rough rachis”. The ligules are hairy and the leaf blades contain small stiff hairs along the blade from the stem to the tip of the leaf. Growth nodes can be found on the rootball when a plant is removed. May be confused with native bunchgrasses, such as bristlegass (*Setaria* spp.); the hairy ligule distinguishes buffelgrass. Proper identification is critical, as native bunchgrasses can compete with buffelgrass for recovery of an area.

Occurrence on PCNRPR Open Space Lands

Buffelgrass can occur in Sonoran desertscrub as well as thornscrub, both xeric and mesic. It is common in natural resource parks and conservation ranches, notably Tucson Mountain Park and Diamond Bell Ranch, although it is documented throughout PCNRPR Open Space Lands. Because of its broad distribution, control should be focused in areas that protect valued assets.



Treatment Options

TREATMENT	SEASON	COST CONSIDERATIONS
Cultural		
Grazing. Reduces biomass but if not combined with other treatment(s), an increase in buffelgrass can be stimulated with a decrease the abundance of native species.	-	-
Prescribed Fire. Though fire is generally not desired in the Sonoran Desert, burning followed with seeding, manual removal, herbicide, or grazing has been shown to increase native plant populations.	WINTER / POST-FIRE	Prescribed fire would be a very localized treatment; wildfires present an opportunity for enhanced control.
Revegetation. Revegetation efforts at Saguaro National Park were successful when caging and watering native perennial plants in former buffelgrass patches. All treatments benefit from seeding with native species, particularly if the natural seedbank is diminished.	MONSOON / POST-MONSOON / FALL / WINTER	Active restoration of native species can prevent secondary infestation of buffelgrass or other invasives and protect treatment investment.
Mechanical		
Hand-pulling. When removing plants by hand, use picks or digging bars and ensure that the entire root ball and nodes have been extracted. If it is not feasible or desired to bag and remove plants from the site, pulled plants should be thatched onsite.	ALL	Very labor intensive. Some locations / terrain may be suitable for volunteer pulls.
Chemical		
Foliar (glyphosate). Glyphosate, in aquatic and terrestrial applications, can be applied to emerged plants during the active growing season when plants are at least 50% green. Applications should be made early in the morning to avoid the highest temperatures of the day.	Primarily with summer green-up; sometimes with green-up after winter rain events	-
Foliar / Preemergent (imazapyr). Apply to rapidly growing plants. If populations are monocultures and the risk of downslope damage to non-targets through soil movement is low, then single applications of imazapyr at 0.56 kg ae ha ⁻¹ be used to kill mature plants and provide preemergence control of the seedbank during periods of dormancy or 1.12 kg ae ha ⁻¹ during periods of active growth.	METHOD DEPENDENT	-
Foliar / Preemergent (hexazinone). Apply to rapidly growing plants. Effective at reducing growth of mature plants >45 days and controls seedlings. Should not be used near shallow water tables.	METHOD DEPENDENT	-
Foliar / Preemergent (tebuthiuron). Provides some control when applied preemergence and is effective at controlling mature plants as well as seedlings.	METHOD DEPENDENT	-

Pennisetum setaceum

Fountain Grass

Treatment Priority: HIGH

Management Goal: ASSET-BASED PROTECTION

Species Description

Fountain grass is a tufted perennial bunchgrass which grows up to 4 ft tall. The leaves are narrow, 8-13 inches long and can be folded or flat. Seedheads are showy, fluffy and purplish with a bottlebrush appearance. Leaves will be sharp when fingers are run against them and can cause injury. May be confused with [native] deergrass (*Muhlenbergia rigens*) which often grows in the same habitat; the seedheads may be needed to distinguish them.

Occurrence on PCNRPR Open Space Lands

Fountaingrass can occur in Sonoran desertscrub as well as thornscrub, both xeric and mesic. It is localized to common in natural resource parks and conservation ranches, notably Tortolita Mountain Park and Six Bar & Diamond Ranches. It is usually found along roads and in drainages.



Treatment Options

There do not appear to be any cultural treatment options for fountaingrass. It is not palatable to livestock and is increased with fire. Treatment options overlap with those for buffelgrass, and so there may be efficiently treated together.

TREATMENT	SEASON	COST CONSIDERATIONS
Mechanical		
Hand-pulling. Remove as much of the root ball as possible. Use picks or digging bars for larger plants. If it is not feasible or desired to bag and remove plants [or at least seedheads] from the site, pulled plants should be thatched onsite.	ALL	Very labor intensive. Some locations / terrain may be suitable for volunteer pulls. Manual removal followed by herbicide treatment can greatly reduce the amount of herbicide needed to control a population.
Chemical		
Foliar (glyphosate). Aquatic and terrestrial formulas available. Apply when plants are green and actively growing. For best results, add a non-ionic surfactant.	Primarily with summer green-up; sometimes with green-up after winter rain events	-
Foliar (imazapyr). Apply when plants are green and actively growing. Mix with a methylated seed oil or a non-ionic surfactant. Allow two full growing seasons before retreatment.	Primarily with summer green-up; sometimes with green-up after winter rain events	-
Foliar / Preemergent (hexazinone). Apply to rapidly growing plants, preferably before a rain event. May contaminate ground water or harm trees. It is best used in dense stands of fountain grass. It may also be combined with glyphosate. Manual removal + hexazinone proved to be more effective than chemical treatment alone.	METHOD DEPENDENT	-
Foliar (fluazifop). Combine with non-ionic surfactant or crop oil to enhance activity. Multiple treatments may need to be made throughout the season.	SPRING; before seedheads emerge and when plants are at least 50% green	-

Tamarix spp.

Shrub Saltcedar

Treatment Priority: HIGH

Management Goal: ASSET-BASED PROTECTION

Species Description

Salt cedar are small trees or shrubs in the *Tamarix* genus with tiny, scale-like leaves. Plants can range from 15-20 ft with blueish green deciduous leaves and with flowers that range from white to pink. Plants reproduce through seeds and stem fragments.

Occurrence on PCNRPR Open Space Lands

Salt cedar can occur in Sonoran desertscrub as well as thornscrub, both xeric and mesic. It is localized to common in natural resource parks and conservation ranches.



Photo by Sue Carnahan

Treatment Options

TREATMENT	SEASON	COST CONSIDERATIONS
Cultural		
Grazing. Goats may be most effective for saltcedar control when used to control young growth and understory growth or in inaccessible areas. Goats grazing after mechanical removal reduced resprout density by greater than 50%. Cattle will also graze on young plants.		
Prescribed burning alone is not a recommended strategy, but can be effective when followed by herbicide treatment to control regrowth. For greatest efficacy, burn in summer when plants are water stressed. Wildfires may present an opportunity to control areas opportunistically.		
Mechanical		
Hand pulling can be effective when plants are young. Easiest when ground is wet.	ALL	
Heavy Equipment can be used to remove entire plants but fragments that happen to move into a water source can resprout. A root plow provides good to excellent control. Roots physically removed with grubbers or excavators must be entirely removed from the soil and dried before burning or mulching. Large mechanical equipment should be able to grasp root ball and remove it in a vertical motion. Root plowing and raking can help clear large, mature stands. Treat in the winter to avoid overheating equipment and disturbing nesting birds. Follow up with a root plow in the summer to sever roots. Most effective when combined with follow up treatments.	WINTER	
Chemical		
Foliar (imazapyr). Provides good control. Add non-ionic surfactant for foliar treatments.	LATE SUMMER / EARLY FALL	
Foliar (imazapyr + glyphosate). Shown to be 90% effective on larger plants. Add non-ionic surfactant for foliar treatments.	LATE SUMMER / EARLY FALL	
Foliar (glyphosate). Provides partial control. Postemergence are most effective if applied shortly after rainfall.	LATE SUMMER / EARLY FALL	
Cut-Stump (triclopyr). The combination of hand-cutting with chainsaws or hand clippers, followed immediately by painting triclopyr on the cut stump, provides good control. Spray stumps within five minutes of being cut.	SUMMER / FALL	
Cut-Stump (glyphosate). Cut stump treatments of concentrated glyphosate can be made year round, avoiding drought conditions.	ALL	
Basal bark (triclopyr). Apply 20-30% Garlon 4 Ultra in oil to young trees.	-	
Biological		
Tamarisk beetles. Some sites show severe defoliation and kill within two years. Biological control alone so far has been shown to be rather rapid (3-4 years after releases of the beetles), and to provide a high level of defoliation and possibly of whole-plant kill, and with the expectation of very low costs from the present time and into the future, of permanent and self-sustaining control, and with no harm to non-target plants	-	No cost. Beetles have currently made it to the Gila Watershed.