

Camelthorn (*Alhagi camelorum*)



Photo credit: NPS



Photo credit: S. Dewey, USU



Photo Credit: M. Licher

Navajo Name
Ch'ilhoshí

Origin
Native to the Mediterranean region and western Asia.

Description
Camelthorn is an herbaceous perennial that grows in a shrub form, between 3 to 6 feet tall. They have alternate simple leaves with long thorns extending from each petiole. Leaves are hairless to nearly hairless and covered in tiny red dots. They have extensive, creepy, woody roots that can grow to a depth of 6 feet and up to 30 to 40 inches away from the main plant. Flowers are magenta to pink pea-like flowers, with two to six on each stalk. Fruits are a reddish-brown seed pod with a beaked tip.



Photo credit: S. Holiday

Biology
Camelthorn prefers sites where their roots can access ground water and is often found in clay soils. They can tolerate some salinity. Their roots associate with nitrogen fixing bacteria, which can change soil chemistry to alter suitability. In cool climates, its leaves become deciduous and in moist sites, its thorns are fewer and smaller while its leaves are larger and more numerous. Flower production is also lower at moist shaded sites. Hard frost can kill above ground parts. Plants reproduce locally through root sprouts, while seeds allow for dispersal at greater distances. Seeds can also survive for at least 8 months when submerged and can survive in soils for more than 20 years in arid soils with viability decreasing in cooler, moister climates.

Locations
Heavy infestations documented near Shiprock, Tuba City, Chinle Wash, the San Juan River Basin, and along the Little Colorado River.

Ecological Threat and Management Concerns
Camelthorn has extensive, tough roots, which make them hard to eradicate. Their roots store extensive reserves that allow them to regrow in response to disturbance. They can grow through pavement and structures, while thorns can flatten tires. Its sharp spines also deter animals from eating the foliage and can interfere and harm animals and humans.

Key ID Tips

- Long thorns the branches and stems at the leaf petioles.
- Tiny red dots on the leaf surface.
- Magenta to pink pea-like flowers.

Camelthorn (*Alhagi camelorum*)

Additional safety measures and limitations may apply for each method. Refer to the [Navajo Nation Integrated Weed Management Plan](#) for more information.

Mechanical/Manual Removal

Most manual and mechanical removal methods are not effective as they stimulate root spread and regrowth. Tilling can also cause resprouting but if done repeatedly during the growing season, it can exhaust underground stores over time.

Biological

No biological control organisms are available.

Cultural Control

Sheep and cattle can graze camelthorn when young and before thorns develop. Cattle may also feed on pods, reducing dispersal to new sites. Burning is not effective as it can stimulate root spread and regrowth in response.

Chemical

Use of herbicides can be effective. Refer to the product labels for information application rates, timing, and approved application methods.

Recommended herbicides include:

- Clopyralid
- Imazapyr
- Metsulfuron methyl
- Picloram*

*Restricted use by U.S. EPA

References

DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center. University of California. 544 pp.

USDA, NRCS. 2023. PLANTS Database. Available at <https://plants.sc.egov.usda.gov/>. National Plant Data Team, Greensboro, NC 27401-4901 USA



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Diffuse knapweed (*Centaurea diffusa*)

Identification and Impacts



Photo credit: J.M. DiTomaso



Photo credit: C. Roche



Photo Credit: Oregon State University

Navajo Name
Ch'il lat'á dei nínigí

Origin
Native to the southeastern Eurasia

Description
Diffuse knapweed is an herbaceous biennial that grows to about 3 tall. Its upper leaves are entire and linear, while lower stem leaves are deeply pinnately lobed and longer. They are also covered with short interwoven gray hairs. Plants start as a basal rosette in the fall and winter and bolt to its flowering stems in the late spring and summer, with many branches. Flowers have spiny, comb-like phyllaries and small white to pale purple disk flowers. Their seeds lack a pappus and disperse when branches break off and tumble across areas by the wind.



Photo credit: M. Lavin, University of Montana

Biology
Diffuse knapweed grows in a variety of sites and thrives in arid to semi-arid environments. It is unknown how long seeds survive in the soil, with some estimates between 2 to 5 years, and some incidences where they have survived longer. Diffuse knapweed does poor in cultivated areas and does poorly in shaded and moist soils. It is also known to hybridize with spotted knapweed.

Locations
Widespread infestations have been documented on the Navajo Nation along roadsides, in mining areas, and in community development areas.

Ecological Threat and Management Concerns
Since some diffuse knapweed seeds can survive for long periods of time, germination in treated sites is common. Dead plants can also act as seed sources when branches break off and create tumbleweeds, depositing seeds in its path. It can increase erosion and sedimentation near open water is decreases habitat and forage quality (USFS 2005)

Key ID Tips

- Spiny, comb-like phyllaries.
- Seeds do not have a pappus.
- Deeply lobed leaves with gray hairs.
- White to purplish small disc flowers

Diffuse knapweed (*Centaurea diffusa*)

Additional safety measures and limitations may apply for each method. Refer to the [Navajo Nation Integrated Weed Management Plan](#) for more information.

Mechanical/Manual Removal

Hand removal is effective for small, scattered populations and should be repeated 3 times a year for at least 5 years. Hand pulling, digging, and tilling should aim to remove at least 2 to 4 inches of the root head below the soil to limit resprouting. Gloves should also be worn. Removal is most effective when done before seed set. Mowing is generally not effective, but if done when blooming, it can reduce seed production. Mowing can also remove dead material to improve herbicide applications.

Biological

Four biological control organisms are available for use on the Navajo Nation. These include three types of seedhead feeding weevils and a root feeding weevil.

Cultural Control

Grazing is not effective but can reduce and control populations. Cattle, sheep, and goat grazing in the early spring can reduce seed production. Grazing in the fall can also reduce plant density over time. Burning can be effective as it can stimulate grass growth. However, burning may stimulate germination. Burning can be used to increase the effectiveness of herbicide applications.

Chemical

Use of herbicides can be effective. Refer to the product labels for information application rates, timing, and approved application methods.

Recommended herbicides include:

- 2,4-D
- Aminopyralid
- Clopyralid
- Diclobenil
- Fluroxypyr
- Indaziflam
- Picloram*

*Restricted use by U.S. EPA

References

DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center. University of California. 544 pp.

U.S. Forest Service. 2005. Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds. U.S. Forest Service Southwestern Region. 601 pp.

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Halogeton (*Halogeton glomeratus*)



Photo credit: C. Shock



Photo credit: G.A. Monroe



Photo Credit: Bureau of Indian Affairs

Key ID Tips

- Succulent with small sessile leaf clusters.
- Stems can appear red as plants mature
- Flowers have showy sepals that appear semi-transparent.
- Flowers also grow in clusters close to the stem.

Navajo Name
Chil' bit'áąh t'ó

Origin
Native to cold deserts of Eurasia

Description
Halogeton is a succulent winter annual that grows to about 1.5 feet tall. It has small fleshy leaves that can appear slightly red or purple when older with an overall bluish-green color and a stiff bristle at the tip. Leaves grow in small clusters close the stem and are alternate and sessile. Flowers grow in clusters on most leaf axils and lack petals. They have small sepals that appear slightly yellow to green and are semi-transparent. Sepals may also look tooth-like. Stems become reddish as plants matures.



Photo credit: Bureau of Indian Affairs

Biology
Halogeton is a succulent that prefers disturbed sites with sparse vegetation in arid to semi-arid regions. They are well adapted to alkaline and saline soils. Plants accumulate salt that can leach from dead plant materials, increasing soil salinity in the top soil. It reproduces solely by seed, which are dispersed by animals and when branches break off and scatter to new sites. Seeds can germinate quickly but do not persist for long in soils.

Locations
Infestations have been found along roads and in disturbed areas such as on Black Mesa near coal mine operations. It is considered widespread on the Navajo Nation.

Ecological Threat and Management Concerns
Halogeton invades disturbed and overgrazed sites. They can alter soil salinity, which favors the continued germination and spread of halogeton in invaded sites. They also produce sodium oxalates, which can be fatal to livestock, especially sheep. As a result, most livestock avoid the bitter plant, which lowers grazing capacity and forage quality in invaded sites.

Halogeton (*Halogeton glomeratus*)

Additional safety measures and limitations may apply for each method. Refer to the [Navajo Nation Integrated Weed Management Plan](#) for more information.

Mechanical/Manual Removal

Pulling and tilling are effective removal methods as plants have shallow roots. Treatments should occur when young and before flowering to prevent seed set. Mowing can be used to reduce seed production. All removed plant parts should be disposed of as they can continue to produce seeds after removal.

Biological

No biological control organisms are available for use on the Navajo Nation.

Cultural Control

Grazing is not recommended due to the toxicity of the plant on livestock. Fire is also not recommended as it can enhance seed germination and increase the density of populations, as halogeton is often one of the first plants to regrow following fire.

Chemical

Use of herbicides can be effective. Refer to the product labels for information application rates, timing, and approved application methods.

Recommended herbicides include:

- 2,4-D
- Imazapic
- Indaziflam
- Metsulfuron methyl
- Picloram*

References

DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center. University of California. 544 pp.

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Johnsongrass (*Sorghum halepense*)

Category B—Medium

Identification and Impacts



Photo credit: C. Evans



Photo credit: S. Dewey, USU



Photo Credit: R.D. Wallace

Navajo Name
Akál

Origin
Native to the Mediterranean region.

Description
Johnsongrass is a tall perennial grass species, growing up to 6 feet tall. Stems are erect with flat leaves that are smooth to sparsely hairy. Leaves have a distinct white mid-rib. Ligules have a fringe of small hairs at the top. They have vigorous rhizomatous roots. Flowers are in open pyramidal-shaped panicles 4 to 20 inches long that darken to a reddish brown to purple as they mature. The seeds can have a single bent awn.



Photo credit: Bureau of Indian Affairs

Biology
Johnsongrass reproduces both vegetatively and by seed. Seeds typically fall near the parent plant and can survive for at least six years, with some instances of them remaining viable for up to 15 years. They prefer disturbed sites and grow best in well-drained soils in warm temperatures.

Locations
It is a common invader of agricultural lands, but no known populations have been documented on the Navajo Nation.

Ecological Threat and Management Concerns
Johnsongrass can invade riparian communities, agricultural sites, forests, and disturbed areas. It can crowd out native species and replace native vegetation. It grows rapidly and can hybridize with commercial sorghum species. While plants can provide forage for livestock, they can produce toxic hydrocyanic acid when stressed, which can be poisonous to livestock. Young plants and regrowth are more toxic and dead material can retain the toxic compounds. It can also host a variety of agricultural pests and diseases.

Key ID Tips

- Distinct white mid-rib on smooth leaves.
- Fruits in sessile spikelet, sometimes with a single awn.
- Seeds in a loose panicle that appears brown to purple.
- Rhizomatous roots.

Management Recommendations

Category B—Medium

Johnsongrass (*Sorghum halepense*)

Additional safety measures and limitations may apply for each method. Refer to the [Navajo Nation Integrated Weed Management Plan](#) for more information.

Mechanical/Manual Removal

Hand removal can be infeasible unless the rhizomes and new sprouts are removed regularly. Larger plants are almost impossible to remove by hand and can often leave rhizomes in the soil to regrow. Removal in early spring is more effective when soils are moist. Repeated, close mowing can be effective at killing seedlings, reducing rhizome growth, and reducing seed production. Tilling can be effective if repeated every two weeks during the growing season.

Biological

No biological control organisms are available for use on the Navajo Nation.

Cultural Control

Grazing is not recommended due to the risk of toxic exposure to livestock. Fire is also not recommended as it can stimulate rhizome growth and reestablishment.

Chemical

Use of herbicides can be effective. Refer to the product labels for information application rates, timing, and approved application methods.

Recommended herbicides include:

- Metribuzin
- Prodiamine
- Paraquat*

*Restricted Use by U.S. EPA

References

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Russian knapweed (*Acroptilon repens*)



Photo credit: M. Licher



Photo credit: J.M. DiTomaso



Photo Credit: Bureau of Indian Affairs

Navajo Name
Ch'ildíich'í'libáhí

Origin
Native to central Asia.

Description
Russian knapweed is an herbaceous perennial that grows to about 3 feet tall. Its stems are erect and branched with leaves covered in gray hair. Leaves are alternate with upper leaves sparse, narrow and lanceolate while basal leaves are oblong, longer and pinnately lobed. Flowers are in panicle to flat-topped clusters with white, pink, to lavender disk flowers, interspersed with bristles. Flowers can remain on stems long after senescence and turn into straw-yellow to ivory achenes with a tuft of hair at the top. As a result, plants can accumulate dead, dry material over time. They have deep roots that branch to form extensive lateral and vertical roots.



Photo credit: P. Alexander

Biology
Russian knapweed grows in many soil types but prefers moist soils and runoff areas. It is extremely drought tolerant and prefers full sun. It can reproduce vegetatively due to its extensive root system and ability to resprout. It produces few viable seeds which can survive for a few years. It also can alter soil chemistry by redepositing zinc to the top soil. Plants begin as a basal rosette before bolting to flowering stems. It also produces unknown toxins that can cause nigropallidal encephalopathy, or "chewing disease" in livestock, which can be fatal.

Locations
It is found throughout the Navajo Nation on farms, rangeland, near waterways, and along roadsides.

Ecological Threat and Management Concerns
Russian knapweed is a vigorous weed that can develop extensive root systems and alter soils to suppress the growth of native vegetation. Its extensive root system makes it difficult to control as pieces as small as 1 cm can regrow. The compounds it produces makes it harmful to livestock, which contributes to reduced grazing capacity and wildlife habitat quality.

Key ID Tips

- Small, pink, purple, to white disk flowers with interspersed bristles.
- Lower leaves are lobed while upper leaves are entire. All covered in gray hairs.
- Extensive, creeping root system.

Russian knapweed (*Acroptilon repens*)

Category B—Medium

Additional safety measures and limitations may apply for each method. Refer to the [Navajo Nation Integrated Weed Management Plan](#) for more information.

Mechanical/Manual Removal

Hand pulling and digging are effective at controlling seedlings but become less effective as plants mature. Mowing can suppress Russian knapweed but will not eliminate populations and can stimulate root growth and density. Though cutting and mowing three times a year does deplete root stores. Tilling is not recommended as it can spread root fragments. Equipment must be thoroughly cleaned to prevent spread to new areas. However, repeated tilling to over 1 feet deep for 3 years can kill much of the roots.

Biological

Four biological control organisms are available for use on the Navajo Nation. These include a nematode, a type of gall midge, and two types of flower gall flies.

Cultural Control

Grazing is not recommended due to the risk of toxic exposure to livestock. Burning is not recommended as it can stimulate regrowth but can be helpful for removing accumulated thatch. Because Russian knapweed does not do well in shaded areas, cultivation of taller native vegetation or crops can help control populations.

Chemical

Use of herbicides can be effective. Refer to the product labels for information application rates, timing, and approved application methods.

Recommended herbicides include:

- 2,4-D
- Aminopyralid
- Clopyralid
- Dichlobenil
- Glyphosate
- Imazapyr
- Triclopyr

References

DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center. University of California. 544 pp.

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Category B—Medium

Russian olive (*Elaeagnus angustifolia*)



Photo credit: J. Randall, TNC



Photo credit: L.J. Mehrhoff



Photo Credit: J. Randall, TNC

Navajo Name
Tsin łibáhá

Origin
Native to Asia.

Description
Russian olive is a deciduous tree species that can reach a height of 25 feet tall. It's leaves are alternate, simple, lanceolate to linear, and are covered in silvery scales or hairs. Leaves, branches, and twigs are covered in silvery star-shaped scales or hairs. Branches may also have long spines along its branches. Flowers grow in clusters with each having a bell-shaped calyx and four acute yellow petals. Fruits can be yellow to red and are covered in the same scales/hairs as the rest of the plant. Bark can appear shaggy and peels off into smooth strips. Its roots can associate with nitrogen-fixing bacteria.



Photo credit: Bureau of Indian Affairs

Biology

Russian olive is considered invasive in much of the western United States as it grows well along riparian corridors. It prefers moist sites and tolerates drought, high water, and freezing and hot temperatures. Plants primarily reproduce by seed, but trees can resprout when cut. Seeds require a combination of stratification (prolonged cool period) and possibly scarification (roughening) for germination.

Locations

Russian olive has invaded several major washes on the Navajo Nation, including Long Canyon, Shonto Wash, Colorado Pueblo Wash, Fruitland, and the streams and tributaries near Shiprock.

Ecological Threat and Management Concerns

Russian olive grows rapidly in the riparian habitats of the southwestern United States, replacing native cottonwood and willow trees that serves as habitat for a number of migratory and sensitive bird species. While its fruits can be used as forage for wildlife, they are less preferable to fruits provided by native trees and vegetation. Thus they reduce habitat capacity and quality.

Key ID Tips

- Simple lanceolate to linear leaves with silvery scales or hairs.
- Can have spines along the growing branches.
- Silvery scales and hairs cover leaves, fruits, branches, and twigs.

Russian olive (*Elaeagnus angustifolia*)

Additional safety measures and limitations may apply for each method. Refer to the [Navajo Nation Integrated Weed Management Plan](#) for more information.

Mechanical/Manual Removal

Hand pulling and digging can be effective at controlling seedlings but become less effective as plants mature. When used on larger trees, they can stimulate regrowth as root fragments can resprout. Girdling and cutting can suppress trees but trees will often resprout from the crown or the root base. Cutting trees in the mid-summer and then mowing resprouts in the summer the following year has been effective but costly. Cutting is more effective when combined with burning or herbicide applications.

Biological

No biological control organisms are available for use on the Navajo Nation.

Cultural Control

Grazing can be used to suppress Russian olive and remove seedlings and resprouts. Burning can remove some above ground material, but plants often resprout in response. Burning combined with cut stump or basal bark treatments with herbicide can be effective.

Chemical

Use of herbicides can be effective. Refer to the product labels for information application rates, timing, and approved application methods.

Recommended herbicides include:

- 2,4-D
- Aminopyralid
- Glyphosate
- Imazapyr
- Triclopyr

References

DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center. University of California. 544 pp.

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Siberian elm (*Ulmus pumila*)



Photo credit: Morton Arboretum



Photo credit: S. Dewey, USU



Photo Credit: T. DeGomez, Univ. of AZ

Navajo Name
Naasts'ósl bit'iis

Origin
Native to northern China, Manchuria, and Korea

Description
Siberian elm, sometimes called Chinese elm, is a fast-growing deciduous tree species that grows to a height of 50 to 70 feet tall. Leaves are alternate, simple, and oblong, usually 1 to 3 inches long. They have serrate margins with well defined venation. Leaf can appear slightly unequal at the base, especially in older leaves. Flowers are small, green, and appear before leaves in early spring. Bark is light gray and irregularly furrowed. The fruits are round, papery, flat samaras that develop in clusters, with each containing one seed.



Photo credit: Bureau of Indian Affairs

Biology
Siberian elm is adapted to a wide range of conditions, including cold and drought, and can tolerate poor soils and low moistures. It is commonly found in dry areas, along roadsides, pastures, and grasslands. They primarily reproduce by seed, which can be carried long distances by the wind. However, they can resprout after treatment. Siberian elm was introduced as a shade tree due to its hardiness and its ability grow fast.

Locations
Found in isolated populations on the Navajo Nation along roadsides, and on homesite and business site lease areas.

Ecological Threat and Management Concerns
Siberian elm can grow quickly and displace native plant and tree species. Individual trees can produce abundant seeds that can be carried long distances by the wind. They can also resprout from cut stumps and branches. Trees can form dense thickets that interfere with wildlife migration and livestock movement.

Key ID Tips

- Round, papery samara fruits
- Simple, alternate leaves with serrated margins.
- Slightly unequal bases.

Management Recommendations

Category B—Medium

Siberian elm (*Ulmus pumila*)

Additional safety measures and limitations may apply for each method. Refer to the [Navajo Nation Integrated Weed Management Plan](#) for more information.

Mechanical/Manual Removal

Hand pulling and digging can be effective at controlling small trees; a weed wrench is recommended. Girdling trees can be effective at killing trees when done in the summer.

Biological

No biological control organisms are available for use on the Navajo Nation. However, there are a few insects in the region known to impact Siberian elm growth.

Cultural Control

Burning is not recommended as it can cause resprouting from adult trees. Grazing is not recommended as it is unknown the impacts on the animals.

Chemical

Use of herbicides can be effective. Refer to the product labels for information application rates, timing, and approved application methods.

Recommended herbicides include:

- Glyphosate
- Imazapyr
- Triclopyr

References

DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center. University of California. 544 pp.

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Saltcedar (*Tamarix ramosissima*)



Photo credit: J.M. DiTomaso



Photo credit: L.J. Mehrhoff



Photo Credit: L.J. Mehrhoff

Navajo Name
K'eilichii'its'óóz

Origin
Native to the Eurasia and Africa

Description
Saltcedars are tall woody shrubs to shrub-like trees with scaly leaves, similar to junipers or cedars. However, their leaves are deciduous, turning yellow to brown in the fall before falling off. Saltcedar flowers can be white to pink with five petals, sepals, and stamens. They grow in dense plumes or spike-like racemes that bloom throughout the growing season. When in bloom, their exerted anthers give the flowers a feathery appearance. Their fruits form a capsule with many feathery hairs. Saltcedars are phreatophytes with deep taproots that can reach the water table.



Photo credit: Bureau of Indian Affairs

Biology
Tamarisk species prefer riparian corridors with saline soils and can grow in arid conditions due to their deep taproots. Their root systems are able to extract water from unsaturated soil layers, which gives them a competitive advantage over native phreatophyte species (Zouhar K. 2003). They also accumulate salt in glands in their leaves that they excrete from the leaf surface, which can accumulate in soils. They can tolerate a range of environmental conditions and are able to outcompete native vegetation to form dense monocultures.

Locations
Saltcedar is common along washes, roadsides, homesite leases, and business site lease areas.

Ecological Threat and Management Concerns
Saltcedar is more common than other tamarisk species and tend to form more dense stands and monocultures. Saltcedar, similar to other tamarisk species, can increase erosion and stream incision, which affects floodplain dynamics. Their deep roots and salt excretions can make it difficult for native plants to survive and can alter soil salinity. They also affect wildlife habitat for several avian species, such as the Southwestern willow flycatcher. They can also increase fire risk in riparian habitats.

Key ID Tips

- Deciduous scaly leaves.
- Five petals, sepals, and stamens in dense, spikelike plumes.
- Fruits are covered in feathery hairs.

Saltcedar (*Tamarix ramosissima*)

Additional safety measures and limitations may apply for each method. Refer to the [Navajo Nation Integrated Weed Management Plan](#) for more information.

Mechanical/Manual Removal

Most mechanical and manual cutting methods are only good at suppressing growth and not for eradication. Hand pulling of small seedlings is feasible for small populations. Grubbing and bulldozing to remove the entire plant are the most effective, but often expensive. Mechanical removal or felling trees is most effective when paired with herbicide treatments to prevent resprouting.

Biological

No biological control organisms are available for use on the Navajo Nation.

Cultural Control

Cattle and goats will graze on young tamarisk or resprouts, but they have little nutritional value. Burning is not recommended for eradicating or controlling tamarisk as it can resprout from its adventitious root system. Burning is recommended for treating removed material. Once removed, restoration of native plant communities is highly recommended to prevent reestablishment.

Chemical

Use of herbicides can be effective. Refer to the product labels for application rates, timing, and approved application methods.

Recommended herbicides include:

- Imazapyr

References

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USDA, NRCS. 2023. PLANTS Database. Available at <https://plants.sc.egov.usda.gov/>. National Plant Data Team, Greensboro, NC 27401-4901 USA.

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