



INVASIVE PLANT MANAGEMENT PROGRAM 2023 WORK PLAN

Invasive plant management in Yosemite National Park is based upon Integrated Pest Management, practical experience, and the best available science. This work plan summarizes the 2022 invasive plant management efforts and describes control actions proposed for 2023.

Comments are welcome. Please address comments to:

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For more information about invasive plants and their management in Yosemite, please visit:
<http://www.nps.gov/yose/naturescience/invasive-plants.htm>

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INTRODUCTION

The Invasive Plant Program (IPP)'s goals are to protect Yosemite National Park's diverse natural and cultural resources from degradation by non-native invasive plants. Yosemite's vegetation constantly changes due to human and natural disturbance and the many human vectors that introduce non-native invasive plants. New invasive plant species and populations are found and treated each year. Limited operational resources for invasive plant control make it critical that treatments are efficient and effective and guided by an annual strategic work plan.

Invasive plant management in Yosemite National Park is directed by the 2010 Invasive Plant Management Plan Update (2010 IPMP) and the 2008 Invasive Plant Management Plan (2008 IPMP). Both publications are available at:
<https://www.nps.gov/yose/learn/management/invasive.htm>

Management actions are based upon integrated pest management (IPM) elements that include prevention, inventory, prioritization, treatment, monitoring, research, education, and outreach. The IPM process includes manual, mechanical, biological, chemical and cultural treatment methods to ensure that the most effective tools are used to protect resources, while posing the least possible impact to people and the environment.

REVIEW PROCESS

All invasive plant management activities are under ongoing internal review by Yosemite's Division of Resources Management and Science as well as other park divisions. External consultation with stakeholders, such as American Indian tribes and groups, also occurs throughout the invasive plant management planning and implementation processes.

Each year, managers develop appropriate invasive plant treatment strategies for each infestation. The treatment method for a locality depends on species, plant phenology (stage of a plant's life cycle), and the availability of methods known to be effective and permitted under the IPMP. A range of site-specific considerations are considered when selecting appropriate treatment methods. Site-specific considerations may include, but are not limited to:

Location	Treatment
Wetland and riparian ecosystems (including the bed and banks of Wild and Scenic Rivers)	Treatment performed in consultation with wildlife ecologists where necessary. Most areas are treated using aquatic herbicides if mechanical methods are determined to be ineffective. Treatments in most meadows are avoided from March 15 – July 15 to avoid ground-nesting birds.

Location	Treatment
Terrestrial ecosystems	Herbicides may be used for high and medium-high priority species if other methods are determined to be ineffective.
Archeological sites	Control near archeological resources conducted in consultation with the Branch of Anthropology and American Indian tribes and groups.
American Indian traditional use areas	Control near traditional use areas carried out in consultation with the Branch of Anthropology and American Indian tribes and groups.
Designated wilderness	The minimum appropriate tool will be used to control invasive species. Herbicide use is allowed if it is determined to be the best tool following the programmatic minimum requirements analysis. Otherwise, manual or mechanical methods are used.
Private in-holdings	Outreach, assistance, and treatment with landowner's permission.
Concessionaire land assignments	Concessionaires are responsible for treatment of invasive plants. NPS staff coordinates with the concessionaire to treat high priority invasive plants following site-specific considerations.
Special status plant habitat	Control near special status plant populations conducted in consultation with botanists in the Branch of Vegetation and Ecological Restoration during planning stages.
Wildlife species of concern and associated habitat	Control near habitat for species of concern conducted in consultation with NPS wildlife ecologists and Fish and Wildlife Service. Species specific mitigations are noted on work plans but are not publicly shared.



FIGURE 1 TREATMENT OF HIMALAYAN BLACKBERRY IN COOKS MEADOW, YOSEMITE VALLEY

Yosemite National Park consults with seven traditionally associated American Indian tribes and groups to ensure there are no adverse effects to historic properties of cultural or religious significance including traditional use areas. Information sharing and project planning will continue in consultation with American Indian tribes and groups throughout the planning and implementation of the field season to ensure that concerns are properly addressed and that management recommendations are fully considered.

Information sharing includes notifications, meetings and field visits, and this annual work plan. This work plan outlines locations, month of treatment, and methods for invasive plant management activities proposed. In response to tribal comments and recommendations, treatment modifications may include using herbicide in lieu of mechanical treatments around archeological sites to avoid soil disturbance or using mechanical rather than herbicide treatments in traditional gathering areas.

SUMMARY OF 2022 WORK

PREVENTION, OUTREACH, AND EARLY DETECTION

Yosemite focuses on five major early detection and outreach programs:

- **Public outreach**
- **Volunteer program**
- **Equipment inspection**
- **Weed-free sand and gravel**
- **Early detection, rapid response**



FIGURE 2 VOLUNTEERS REMOVING BULL
THISTLES IN YOSEMITE VALLEY

PUBLIC OUTREACH

Invasive plant managers communicate with visitors, local communities, and other land managers. The invasive plant website, <http://www.nps.gov/yose/naturescience/invasive-plants.htm> provides abundant information appropriate for both visitors and other land managers. Additionally, the invasive plant crew offers consultation and treatment assistance for park inholdings and park neighbors.

VOLUNTEER PROGRAM

Volunteers are an essential component of the Yosemite Invasive Plant Program (Figure 2). In 2020, nearly all volunteer groups were suspended due to Covid-19. In 2022 the program

supported limited volunteer assistance. In 2023, volunteers will likely return to pre-pandemic levels, following all applicable public health policy and guidance.

EQUIPMENT INSPECTION



FIGURE 3 HEAVY EQUIPMENT INSPECTED TO ENSURE WEED SEEDS ARE NOT TRANSPORTED INTO THE PARK

The Invasive Plant Program collaborates with the Divisions of Facilities Management and Project Management to inspect all incoming heavy equipment (Figure 3). Prior to these inspections, heavy equipment was a major source of invasive plant propagules. Now, most contractors fully comply with this program and few pieces of equipment are denied access to the park each year. Over 90 pieces of heavy equipment were

inspected. These inspections remain an important and cost-effective program to prevent the introduction of invasive plants.

WEED-FREE SAND AND GRAVEL

Non-native plants can be introduced by imported sand and gravel (aggregate). To prevent invasive plant introductions, resource managers inspect quarries for invasive plants and work with quarry operators to treat them before the material is brought to the park. Five quarries were surveyed in 2022. Quarries identified for use in projects in 2023 will be surveyed.

EARLY DETECTION, RAPID RESPONSE

Invasive plant management has the highest probability of success when populations are found in the early stages of an infestation. Every year a population is left to expand unchecked it becomes more difficult to control and has a greater impact to native plant communities. Additionally, the financial cost of treatment increases exponentially. As such, resource managers ensure that new populations of invasive plants are discovered early, and treatment is performed soon thereafter.

Within the past five years, staff found three new non-native species to the park including salt cedar (*Tamarix ramosissima*) in the Grand Canyon of the Tuolumne, buffalobur nightshade (*Solanum rostratum*) at Badger Pass, and reed canary grass (*Phalaris arundinacea*) in Yosemite Valley. Salt cedar is highly invasive in riparian areas and is known for its ability to alter habitats. Reed canary grass is native to other parts of California, but is highly aggressive in riparian habitats.



FIGURE 4 BIOLOGISTS COLLECT GPS DATA THAT IS CRITICAL FOR A SUCCESSFUL INVASIVE PLANT MANAGEMENT PROGRAM. HERE BIOLOGISTS SURVEY MEDUSAHEAD IN ACKERSON MEADOW.

Early detection surveys also discovered notable range extensions including medusahead (*Elymus caput-medusae*) and barbed goatgrass (*Aegilops triuncialis*) in Foresta. Bull thistle was found at Tuolumne Meadows, a new elevation record. In 2021, three populations of yellow star thistle were found on Wawona and Big Oak Flat Roads. All of these early detection discoveries were followed up with immediate treatment and those sites will continue to be monitored in 2023.

Ackerson Meadow, a new addition to the park, will continue to be surveyed extensively and treated primarily for velvet grass and medusahead. Other novel invasive species will continue to be mapped in Ackerson Meadow.

PRIORITIZATION

Currently, 291 non-native plant taxa occur in Yosemite. While many of these non-native plants do not pose a threat to park resources, some non-native plants, also known as “transformer species”, have the potential to form monotypic stands, greatly altering resource availability, trophic structure, ecosystem productivity, and/or natural disturbance regimes (D'Antonio et al. 2004). Program managers used three main characteristics to determine the priority order for invasive plant control: 1) current impacts on park resources 2) potential threat on park resources and 3) feasibility of control. Program managers assigned a low-priority ranking to species that did not meet at least one of the following criteria:

- Present on the California Department of Food and Agriculture (CDFA) List of Noxious Weeds (Schoenig 2005)

- Present on the California Invasive Plant Council (Cal-IPC) list of Invasive Non-Native Plants that Threaten Wildlands in California (Cal-IPC 2006)
- Present on the U.S. Geological Survey (USGS) Alien Plant Species Threat Assessment for Yosemite (Gerlach et al. 2003)

Many of these low priority non-native plant species are restricted to disturbed areas such as road corridors, campgrounds and parking areas, and do not appear to be spreading into natural areas. Other low-priority species are so widespread within Yosemite and surrounding areas (e.g., some Mediterranean annual grasses) that control is not feasible.

SPECIES TREATMENT SUMMARIES

In 2022, 984 acres were surveyed for non-native plants. Field staff actively visited and documented 242 gross infested acres of non-native plants. Of that, 186 gross infested, or 42.6 canopy acres were treated.

A gross acre includes target plants and the spaces between them, or the whole area of an infestation. A canopy acre is the area covered only by target plants within an infestation. E.g. one gross acre of velvet grass with 10% cover has 0.1 canopy acres. The treatment summaries for high and medium-high priority species are described below.

YELLOW STAR THISTLE (*CENTAUREA SOLSTITIALIS*)

Each field season begins with the program's most ambitious and challenging project—the treatment of yellow star thistle in El Portal. This infestation grows in difficult terrain with steep slopes that require the use of ropes by treatment crews for fall protection in some areas. Park personnel treat infestations in cooperation with neighboring US Forest Service and private landowners.

In 2022, crews treated 4.6 gross infested acres, or 0.49 canopy acres, of yellow star thistle. Invasive plant crews covered many previously known yellow star thistle infestations within park boundaries and expanded treatment into new areas outside the park. After several years of treatment, yellow star thistle density has undergone drastic reductions since treatments began (Figure 7).

Yellow star thistle was found and treated in three new locations on Wawona and Big Oak Flat Roads. These were isolated individuals or very small populations that were treated before the plant could establish.

HIMALAYAN AND CUT-LEAF BLACKBERRY (*RUBUS ARMENIACUS* AND *R. LACINIATUS*)

Crews treated 16.54 gross infested acres or 3.89 canopy acres of non-native blackberry in 2022. Crews completed treatment of many accessible blackberry infestations in Yosemite Valley, Hetch Hetchy area, and smaller infestations in Foresta and Wawona. Backpack

sprayers were used to treat infestations in most areas but the “cut and dab” method was employed in some traditional use areas and around rare plant species (Figure 5). Treatment has successfully reduced blackberry cover across the park, leading to a steady downward trend of treated acres since 2009 (Figure 7).

WALL HAWKWEED (*HIERACIUM MURORUM*)

Wall hawkweed was not known to occur in California prior to the discovery of this population in 2010. Wall hawkweed was found at the Tacoya housing area and near the Ahwahnee Hotel in Yosemite Valley.

BULL THISTLE (*CIRSIIUM VULGARE*)

Volunteers and staff treated 71.2 gross infested acres, or 5.54 canopy acres of bull thistle. Of the 5.54 canopy acres treated, 5.4 acres of dense populations were treated with crews applying herbicide. Volunteers treated the remaining acres by shovel shearing. Bull thistle is widespread in the park and is found in Yosemite Valley, Wawona, Mariposa Grove, designated Wilderness, and in some recently burned areas.

SPOTTED KNAPWEED (*CENTAUREA STOEBE*)

Crews conducted follow up surveys and treatment in an ongoing effort to eradicate spotted knapweed in Foresta. In 2014 surveyors found several large, previously unknown populations. These discoveries prompted managers to reevaluate their methods and begin treatment of this species with aminopyralid in 2015. Herbicide treatments increase the effectiveness of control efforts by targeting small and difficult to see seedlings of invasive plants that surround larger individuals and by providing some pre-emergent control. In 2021, a few individuals were found in some previously known locations in Foresta. Many areas that have been treated since 2015 had no individuals in 2021. This indicates a successful effort to draw down the seed bank, but that continued efforts are necessary to ensure eradication.

In 2015, a single individual was found along the Mist Trail, one of the most heavily used trails in the park. Another individual was found in Yosemite Valley near the El Capitan Picnic Area in 2016. An individual was found by the NPS Warehouse building in 2017.

OXEYE DAISY (*LEUCANTHEMUM VULGARE*)

Crews treated 3.7 gross infested acres, or 0.23 canopy acres, of oxeye daisy in Big Meadow and Foresta with aminopyralid. Three individuals of oxeye daisy were found by the golf course in Wawona and one was found in residential Wawona in 2018. This species is widely distributed in Big Meadow.

VELVET GRASS (*HOLCUS LANATUS*)

Velvet grass infests hundreds of acres of Yosemite meadows. Control efforts for velvet grass consisted of treating 12 gross infested acres, or 5.12 canopy acres. These areas included treatment at Hodgdon, Ackerson meadow, Wawona and Yosemite Valley. Treatment will continue in isolated populations with the goal of local eradication and improvement of pollinator habitat in Yosemite Valley meadows. A major effort will continue in Ackerson Meadow to prevent this species from spreading into a large restoration project.

CHEATGRASS (*BROMUS TECTORUM*)

Cheatgrass is a major invader of the foothill woodlands and is spreading into new areas within the park. After the Ferguson Fire, cheat grass invaded dozer lines around the community of Foresta. The cheat grass was treated and reseeded with native plant seed.

Cheatgrass and other annual invasive grasses were treated in select areas in coordination with other projects. Annual invasive grasses were treated at restoration sites in Yosemite Valley.

TREATMENT EFFECTIVENESS



FIGURE 5 INVASIVE PLANT PERSONNEL COMPLETE TREATMENT OF BLACK SPRINGS INFESTATIONS USING CUT AND DAB TECHNIQUES. PHOTOS FROM LEFT TO RIGHT ARE BEFORE TREATMENT, THE APPLICATION PROCESS AND AFTER REMOVAL

TREATMENT HISTORY TRENDS

Yosemite invasive plant managers track the volume and location of herbicide use. The following figures show the number of canopy acres treated for all species annually (Figure

6) and the number of canopy acres treated by the most common species (Figure 7). Figure 8 shows the gross infested acres treated in 2021 by major species. Figure 9 shows the number of gallons of each herbicide concentrate applied over time since 2009. Figure 10 shows the breakdown of aminopyralid concentrate use per species since 2009, and figure 11 shows the same for glyphosate.

Note, a gross acre includes target plants and the spaces between them, or the whole area of an infestation. A canopy acre is the area covered only by target plants within an infestation. E.g. one gross acre of velvet grass with 10% cover has 0.1 canopy acres. The treatment summaries for high and medium-high priority species are described below.

The figures show for both Himalayan blackberry and yellow star-thistle the number of gallons of herbicide increased from 2009 to 2010 and began to decrease by 2012. This decrease is attributed to treatment success over time, and further decline continues. The decline due to treatment success is also observed when examining the number of canopy acres treated over eight years (Figure 7).

Note the differences in vertical axes in figures 9 and 10. In figure 9, the gallons of herbicide concentrate are listed on the left vertical axis, and the grams of rimsulfuron are shown on the right vertical axis. Figure 10 breaks out the use of aminopyralid per species and shows a scale of 0.1 gallon because that herbicide uses a much lower volume of concentrate than other herbicides.

While the number of acres treated decreased from 2010 to present, the area surveyed by invasive plant crews increased consistently. As treatments of Himalayan blackberry and yellow star-thistle are successful, there is more time available to survey new areas and treat additional non-native plant species. This is illustrated by the increase of all other species treated (Figure 7).

At the peak of the Himalayan blackberry infestation, 130 canopy acres of Yosemite were infested, of which 100 acres were in the Merced River corridor. Today, surveys indicate there are less than 6 canopy acres left in the Merced River corridor. Rigorous, comprehensive treatments have reduced the Himalayan blackberry population by 93% in ten years.

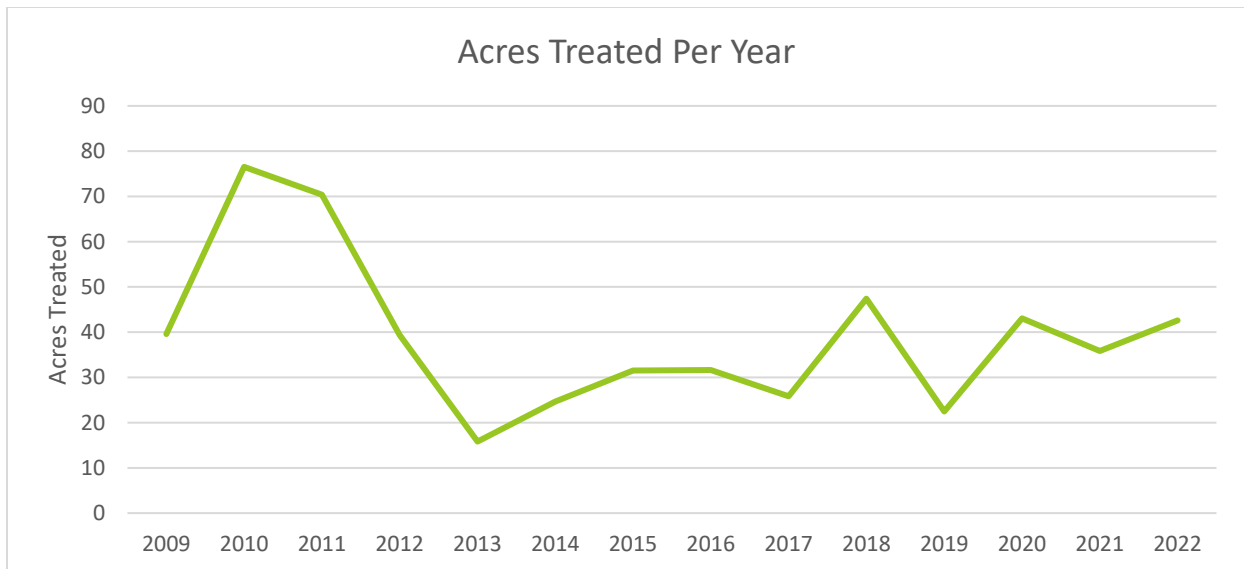


FIGURE 6 NUMBER OF CANOPY ACRES TREATED FOR ALL SPECIES PER YEAR SINCE 2009.

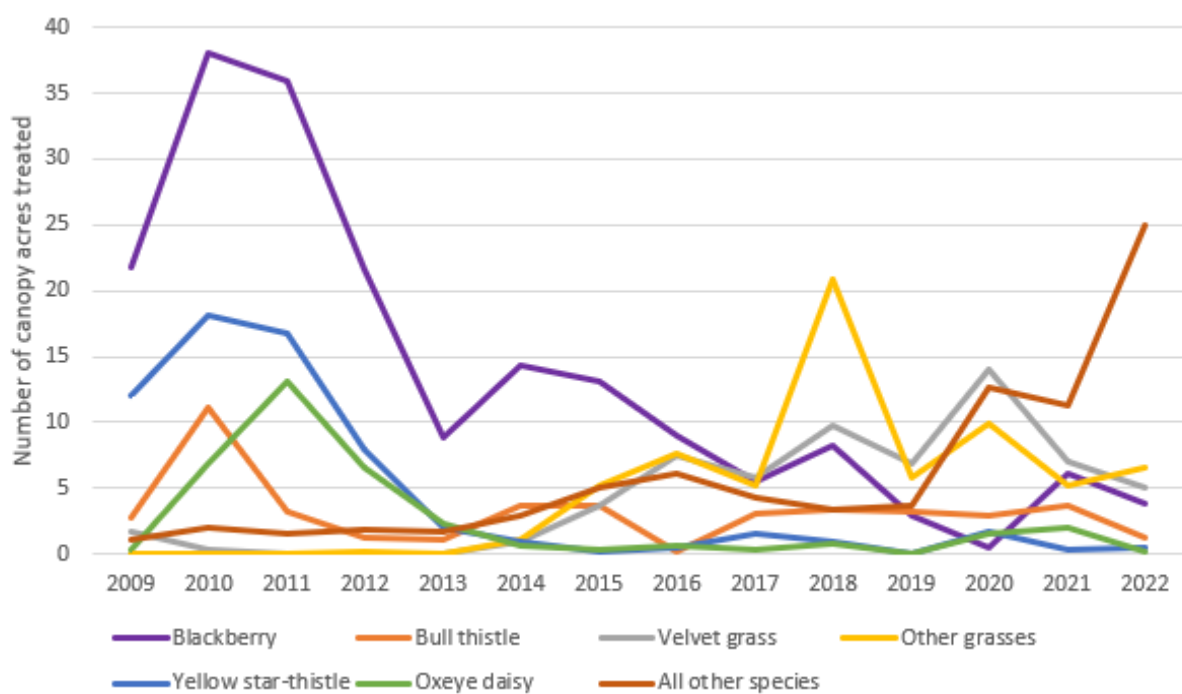


FIGURE 7 THE NUMBER OF CANOPY ACRES TREATED FROM 2009 TO 2022. THE PRIMARY INCREASE IN OTHER GRASSES TREATED IN 2018 IS MEDUSAHEAD AFTER THE ACQUISITION OF ACKERSON MEADOW TO THE PARK.

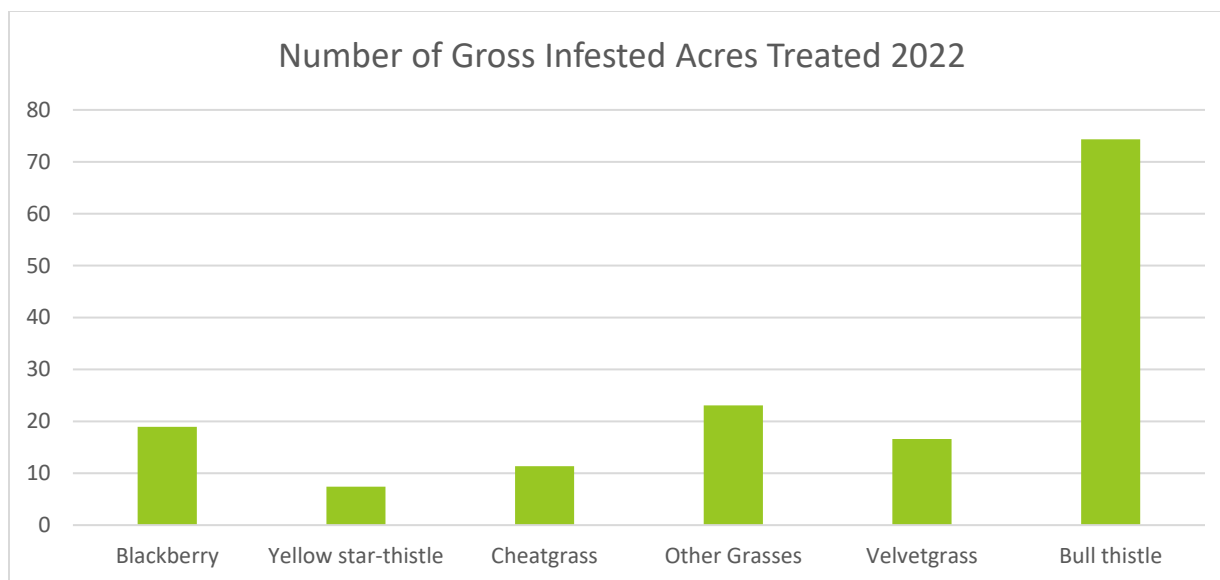


FIGURE 8 THE NUMBER OF GROSS INFESTED ACRES TREATED IN 2022 FOR BULL THISTLE, YELLOW STAR THISTLE, BLACKBERRY, VELVET GRASS, YELLOW STAR THISTLE, OTHER GRASSES (EXCLUDING VELVET GRASS AND CHEAT GRASS), OXEYE DAISY, CHEAT GRASS, AND ALL OTHER NON-GRASS SPECIES (E.G. DANDELION, EARLY DETECTION SPECIES). GROSS INFESTED ACRES INDICATE THE INFESTATION SIZE, INCLUDING ALL AREA BETWEEN PLANTS.

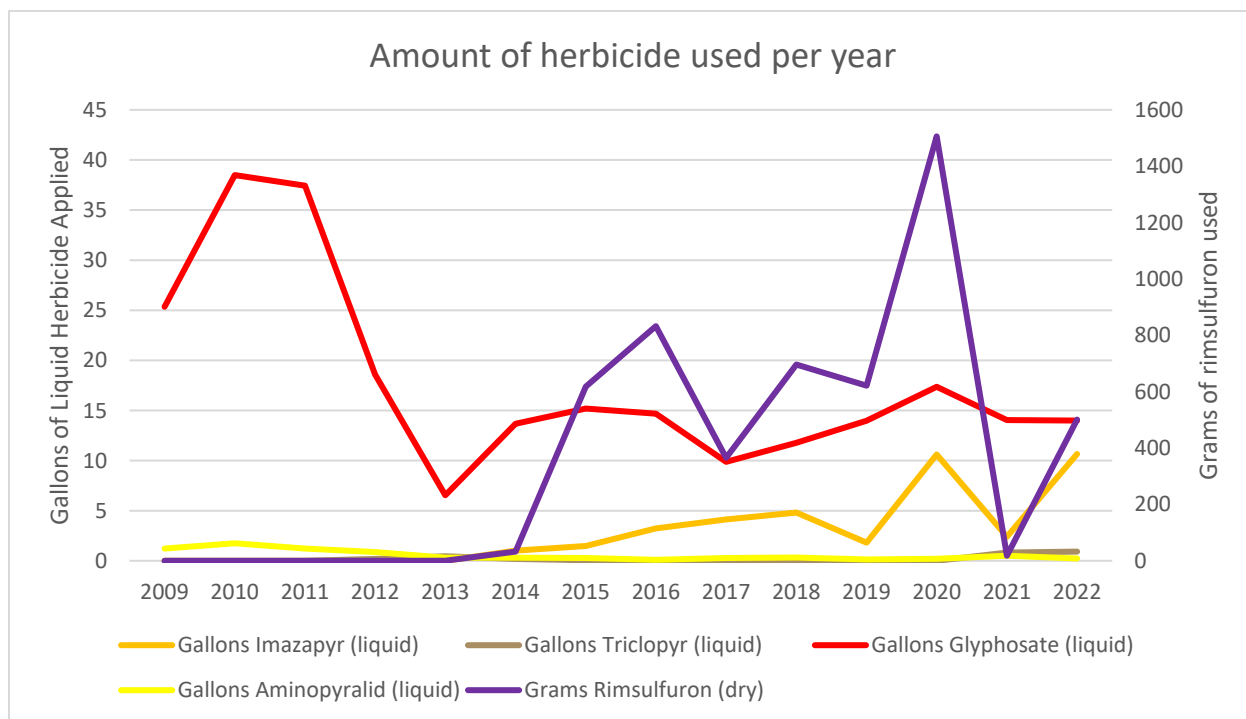


FIGURE 9 THE AMOUNT OF HERBICIDE CONCENTRATE USED SINCE 2009

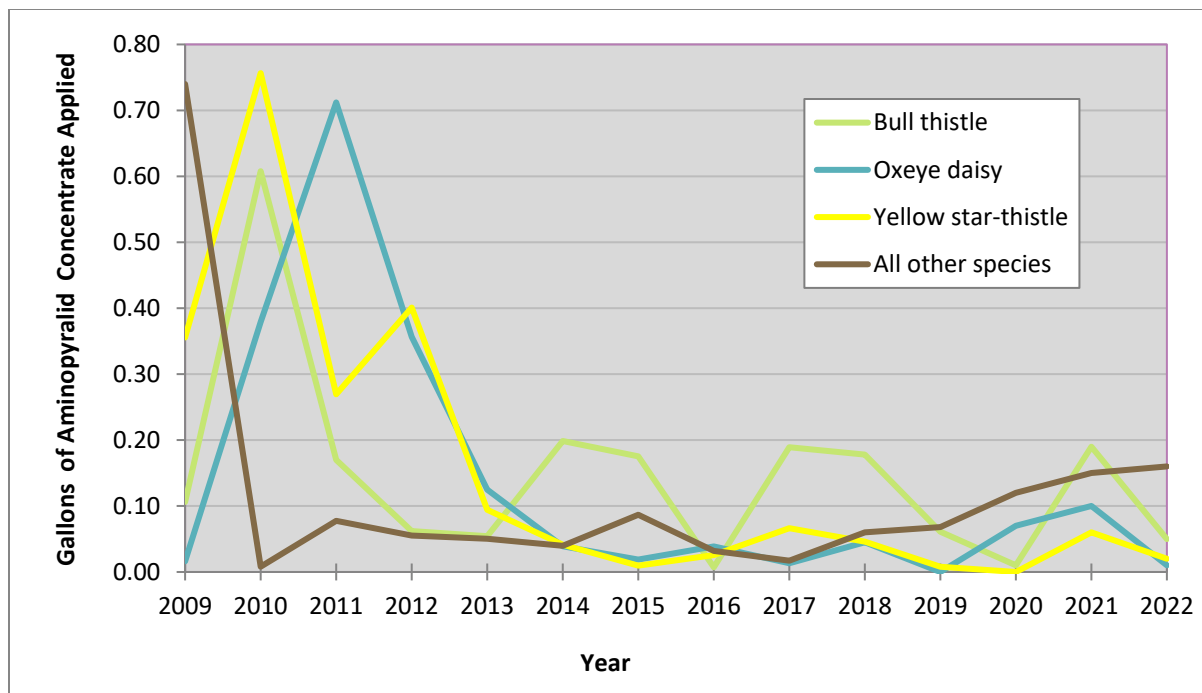


FIGURE 10 THE AMOUNT OF AMINOPYRALID CONCENTRATE USED PER SPECIES PER YEAR SINCE 2009

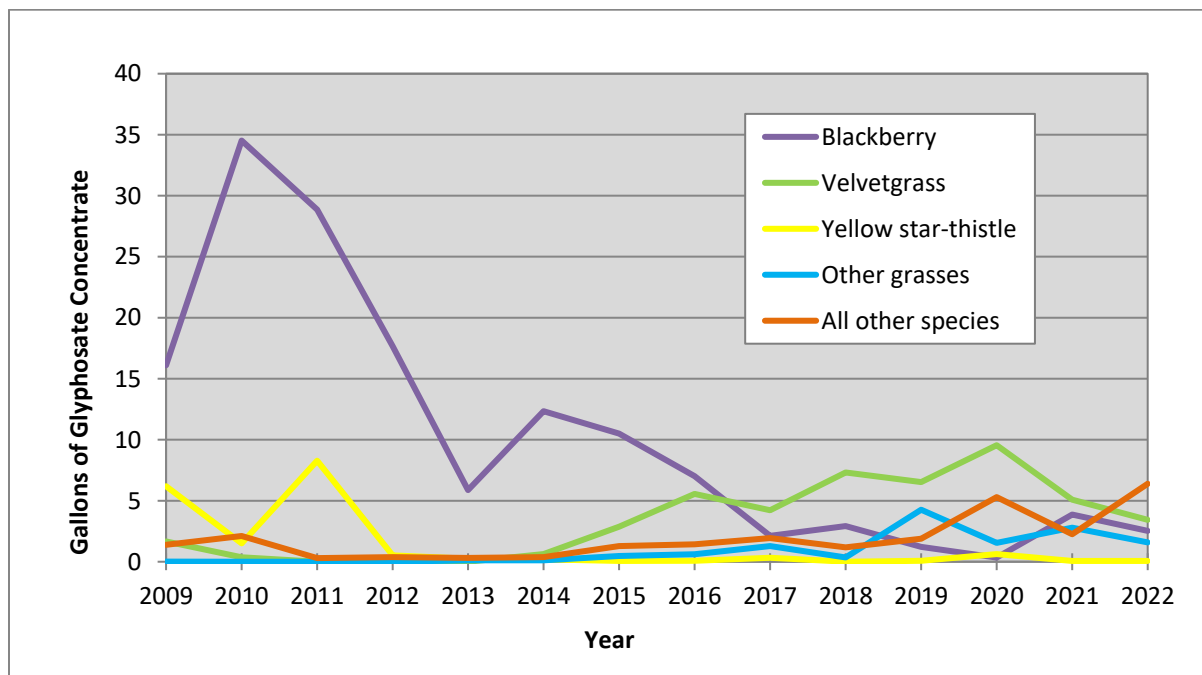


FIGURE 11 THE AMOUNT OF GLYPHOSATE CONCENTRATE USED PER SPECIES PER YEAR SINCE 2009

MANUAL TREATMENT VERSUS HERBICIDE TREATMENT OF BLACKBERRY

Prior to 2009, Himalayan blackberry was manually and mechanically treated and only in easily accessible sites in Yosemite Valley. In rocky and remote terrain, it is not possible to manually remove blackberry roots effectively. Manual methods involve heavy soil disturbance and major impacts to native vegetation and cultural resources. After years of exhaustive treatments and retreatments of blackberry in Yosemite Valley, these sites were often recolonized by new invasive plants, such as bull thistle and velvet grass due to the heavy soil disturbance. Trial plots that compare herbicide use and manual hand removal show herbicide treatments foster better and more rapid native species recovery (Figure 12).



FIGURE 12 BEFORE (TOP) AND AFTER (BOTTOM) PHOTOPOINTS OF MECHANICAL TREATMENTS (LEFT) AND HERBICIDE TREATMENTS (RIGHT) ON BLACKBERRY. AFTER (BOTTOM) PHOTOS WERE TAKEN ONE YEAR AFTER TREATMENT.

2022 WORK PLAN

This work plan describes the methods and locations of control actions for high and medium-high priority invasive species. The plan consists of 1) planning maps (in a separate document) 2) treatment plans for managed species at each priority level (high, medium-high, medium to low priority species) 3) early detection species 4) early detection sites and 5) treatment plans by general locations.

New invasive plant species and new populations of high priority plants are found each year. The most effective way to protect the park from new invasions is through rapid response to these early detections. Because of this, on a limited basis, crews may apply treatments that are not explicitly described in this document and on the maps. Some plants survive initial treatment, so crews will monitor previously treated sites and retreat as needed.

DETAILED PLANNING MAPS

This plan includes a set of maps that provide site-specific treatment details to park staff and the public. These maps are critical to help guide the field crews' decision-making. The maps display invasive plant infestation data collected in the field since 1995. Invasive species often co-occur, showing up on a map as a feature within a feature. The treated area of one species' infestation can overlay the larger infestation of another species.

LIST OF TERMS

TREATMENT TECHNIQUES

SPOT SPRAY	Targeted application of herbicide focused only on the foliage of the target plant species using a backpack sprayer or a truck-mounted sprayer. Targeted applications reduce drift and result in minimal impact to non-target plants.
FRILL CUT	Used on trees or large shrubs; a diagonal cut into the bark is made prior to herbicide application to aid delivery of herbicide into the target plant.
CUT STUMP	Used on trees and shrubs; a tree is cut near ground level before herbicide is applied directly to the stump of the target plant.
HAND-PULL	Removal of target plant biomass, including the roots, by hand.
LOP AND GRUB	Above ground plant is cut with loppers and then the (often deeper) root system is dug out; very time intensive.
SHOVEL-SHEAR	Plant is severed a couple inches under the ground surface using a shovel; some root material remains.

DEAD-HEAD	Flowers and seeds are removed to prevent spread by seed.
CUT AND DAB	Plants are cut a few inches from ground and herbicide is applied to the stump.
MOW	Above ground plant material is cut using hand or power tools. This method removes reproductive parts before they mature, but leaves the target plant alive.

MONITORING ACTIVITIES

SURVEY	A systematic search for target plants.
GRID SURVEY	A line of people collectively search for target plants and increase survey effectiveness.
MAP	To document infestations; most often using GPS units.
GPS	Global Positioning System; use of satellite technology to pinpoint location; used to map infestations with handheld units.
MONITOR	All activities that examine results of management actions; for example, observation of a site after treatment to document the outcome of that treatment.
PILOT STUDY	A quantitative study to assess effectiveness of a new treatment.

TREATMENT PLAN FOR HIGH-PRIORITY SPECIES

CHEATGRASS (BROMUS TECTORUM)

This plant is widespread in Yosemite and is extremely difficult to control. Cheatgrass and other similar annual grasses have severe ecological impacts, but are widespread in the lower elevations of Yosemite with little management options. The IPP targets roadside populations for fire prevention in the Wildland Urban Interface, some dense populations in conjunction with restoration efforts, and where it is found in isolated populations at higher elevations.

Cheat grass will be treated along Glacier Point Rd. and Tioga Rd. where it occurs at its highest elevations in the park in isolated populations. The goal of these treatments is to prevent its continued spread into higher elevations and wilderness areas. Cheatgrass will also be treated in areas around restoration sites in Yosemite Valley and Ackerson Meadow to limit its competition with restored native species.

Post emergent treatments of cheatgrass will be conducted with glyphosate and/or aminopyralid in spring prior to seed set. Cheatgrass is a winter annual species that

germinates with the first fall rains each year. Rimsulfuron will be used on the early flush of cheatgrass as a post-emergent treatment on young plants. Rimsulfuron also provides some pre-emergent action on the seed bank preventing additional germination later in fall-early spring.

ITALIAN THISTLE (*CARDUUS PYCNOCEPHALUS*)

This California-listed noxious weed has several populations within Yosemite's boundary, in El Portal, the Mariposa Grove, Yosemite Valley, and near the Hetch Hetchy entrance station. Large infestations occur at the park border in El Portal, and on Forest Service and private land near El Portal. Potential habitat will be surveyed in surrounding areas and known infestations will be resurveyed and treated with aminopyralid.

The previously treated populations at the Mariposa Grove, Yosemite Valley, and Hetch Hetchy Entrance Station will be monitored to ensure eradication at those locations. The aggressive nature and short growing season of Italian thistle makes it one of Yosemite's most threatening invasive plants.

SPOTTED KNAPWEED (*CENTAUREA STOEBE*)

Since its accidental introduction to Foresta in 1990, crews have repeatedly treated spotted knapweed with the goal of eradicating it from Yosemite. Single individuals or small groups have been detected in a handful of other locations in the park and were likely treated quickly enough to prevent establishment at those locations. All previously known locations will be monitored in 2023, and any individuals found will be treated with aminopyralid.

YELLOW STAR THISTLE (*CENTAUREA SOLSTITIALIS*)

Extensive grid surveys targeting yellow star thistle occur annually in El Portal and Foresta. Aminopyralid, glyphosate, or imazapyr is applied to the plants in spring. Disjunct populations and individuals found along Big Oak Flat Road, Wawona Road and near Hetch Hetchy will continue to be monitored to ensure that those populations have been eradicated.

RUSH SKELETONWEED (*CHONDRILLA JUNCEA*)

This highly aggressive invasive plant was discovered in Yosemite in 2013 along El Portal Road just below Yosemite Valley. Repeated herbicide applications of aminopyralid or imazapyr will be used to control the existing populations and areas nearby will continue to be surveyed.

BULL THISTLE (*CIRSIIUM VULGARE*)

Bull thistle is presently the most widespread high-priority invasive plant in Yosemite. The majority of bull thistle treatments will be conducted by volunteer groups using manual

methods, typically shovel shearing. The invasive crew will conduct targeted herbicide treatments of high-density populations in Yosemite Valley, the Mariposa Grove, and within recent fire perimeters.

MEDUSAHEAD (*ELYMUS CAPUT-MEDUSAE*)

Medusahead is a highly invasive grass that reduces forage quality and increases fire return intervals. Three small populations were found in Foresta in 2014, and one larger infestation at the Crane Flat Fire Lookout and Helibase. A large population was found in and treated in Foresta along the Old Coulterville Road in 2015. One more additional population was found in El Portal at an emergency vehicle parking pullout. All populations were treated manually upon their discovery and treated aggressively with applications of glyphosate and rimsulfuron in the past three years. Newly discovered medusahead populations were surveyed and treated in Ackerson Meadow.

Surveys in 2022 found no individuals in the El Portal populations and will continue to be monitored to ensure eradication. The populations in Foresta will be monitored and treated in 2023. A few individuals were found at Crane Flat Helibase, indicating successful treatments are reducing the seed bank. The density of individuals in Ackerson Meadow have been drastically reduced, but there is still a significant infestation there. Treatments with both glyphosate, aminopyralid, rimsulfuron and handpulling will continue in 2023 at the Crane Flat Helibase and Ackerson Meadow.

BROOM SPECIES (*GENISTA MONSPESSULANA*, *CYTISUS SCOPARIUS*, AND *CYTISUS STRIATUS*)

All broom species (*Genista* spp. and *Cytisus* spp.) present within Yosemite are known to be highly invasive. These plants were introduced to residential areas in Yosemite as ornamentals and have spread quickly. Crews will treat French broom (*Genista monspessulana*) on NPS land with aminopyralid. All known Scotchbroom (*Cytisus scorpius*) populations in Wawona will be monitored and retreated as needed.

VELVET GRASS (*HOLCUS LANATUS*)

Velvet grass infestations will be treated with glyphosate in certain areas. Treatments will focus on small populations within intact native plant communities, where eradication is feasible, such as those at Merced Lake, Lake Vernon, and Sunrise Creek. Small populations found in the wilderness, along roads and trails, or anywhere with a high likelihood of dispersal into natural habitats will also be a main target. Populations at Hetch Hetchy Entrance station, Hodgdon Meadows, Royal Arches Meadow, Ackerson Meadow and Miguel Meadows will be treated with glyphosate. Some additional Yosemite Valley populations will be treated to prevent their spread into adjacent disturbed areas and/or restoration sites.

HIMALAYAN AND CUT-LEAF BLACKBERRY (*RUBUS ARMENIACUS* AND *R. LACINIATUS*)

Himalayan blackberry constitutes the majority of invasive blackberry within Yosemite, but cut-leaf blackberry has also proven to be an aggressive invader. The main treatment method is glyphosate applied from backpack sprayers. Invasive plant crews will treat blackberry from late July-November, possibly as late as December in El Portal. Crews may cut and dab populations located near special status plants, important cultural sites, or water.

TREATMENT PLAN FOR MEDIUM-HIGH PRIORITY SPECIES

GOATGRASS (*AEGILOPS CYLINDRICA*, *AEGILOPS TRIUNCIALIS*)

Two species of goatgrass were found in 2012 and 2013. These grasses have caused considerable ecological damage in rangelands throughout California and now threaten grasslands along the western border of Yosemite. *A. triuncialis* has been treated with rimsulfuron and glyphosate the past four years where it occurs along Big Oak Flat Rd. near Foresta. *A. cylindrica* has been mowed annually by NPS fire personnel as part of a fuels reduction program since its discovery in 2012. It has been treated with herbicide in some years, including 2022. In 2023, both species will be treated with glyphosate or aminopyralid in early spring followed by a fall treatment of preemergent rimsulfuron.

TREE-OF-HEAVEN (*AILANTHUS ALTISSIMA*)

Known populations exist in El Portal and Yosemite Valley. Crews will cut stump, basal bark, or spray foliage of small plants as appropriate. In El Portal, where many plants are located near homes, NPS crews will be available to help homeowners eradicate this species.

GIANT REED (*ARUNDO DONAX*)

Although giant reed is a widespread problem in California, there are only two known populations in Yosemite, in residential areas of El Portal. Crews treated this population with glyphosate from 2010 to 2013 and manually treated in subsequent years. Arundo will continue to be monitored and retreated annually until these populations are eradicated.

SMOOTH BROME (*BROMUS INERMIS*)

Smooth brome currently occupies many canopy acres within Yosemite and occurs almost entirely as monotypic stands. Smooth brome occurs sporadically in high elevation locations along Tioga Road and will be treated in 2023. All high elevation populations will be treated with glyphosate. Dense infestations occur throughout Yosemite Valley. Some of these are treated to prevent the species spread into adjacent disturbed areas and/or restoration sites.

HOPS (*HUMULUS LUPULUS*)

Hops infest at least 3.4 acres in El Portal, Wawona, Carlon and several sites in Yosemite Valley. Approximately .5 acres were monitored in 2022. Hops populations will be treated with imazapyr as time allows.

WALL HAWKWEED (*HIERACIUM MURORUM*)

Wall hawkweed has only two known populations within the park. Both locations will be monitored in 2023. If any individuals are found, they will be treated with aminopyralid have been conducted and will continue until this species is eradicated.

KLAMATHWEED (*HYPERICUM PERFORATUM*)

Infestations of Klamathweed will be treated with aminopyralid or glyphosate. Treatments will be concentrated along transportation corridors, in isolated occurrences, within the footprint of the Ferguson fire in Foresta, and where it occurs adjacent to disturbed areas and/or restoration sites in Yosemite Valley.

OXEYE DAISY (*LEUCANTHEMUM VULGARE*)

The preferred treatment method for oxeye daisy is to spot spray with aminopyralid. In 2014 populations were discovered in Cooks Meadow, and in a fire suppression hand line near Harden Lake. After several years of treatment, there were no plants found in 2021 at the isolated Harden Lake population. This site will continue to be monitored in 2023 to ensure it is eradicated. Areas adjacent to development and roads will be treated in 2023 to contain this species and stop it's spread to the rest of the park.

DALMATIAN TOADFLAX (*LINARIA DALMATICA*)

Dalmatian toadflax is escaping cultivation in one location in Yosemite West. This is a highly aggressive and difficult to control invader. It has waxy leaves and an extensive root system making both manual and herbicide treatment less effective. Treatment will require cooperation of the land owner. It has not yet been treated.

BLACK LOCUST (*ROBINIA PSEUDOACACIA*)

Yosemite Valley black locust populations are spreading and have been found as far downriver as the Rostrum. Many populations have been treated and will be monitored and retreated as needed. Newly discovered populations will be treated with cut stump treatments of glyphosate or triclopyr. Basal bark applications of triclopyr or foliar treatments of glyphosate will be used on small individuals.

JOHNSON GRASS (*SORGHUM HALEPENSE*)

Johnson grass has been observed in El Portal, Yosemite Valley, and along Wawona Road. Populations remain small and isolated, so eradication is possible. This plant does not respond to mechanical treatments so all infestations will be treated with foliar applications of glyphosate or imazapyr.

DANDELION (*TARAXACUM OFFICINALE*)

Dandelion is a medium-high priority species above 7,000 and a low priority below 7,000 feet. One of the few invasive plants that succeed at the highest elevations of the park, populations have been observed on the USFS side of Mt. Dana, along the Mono pass trail, in pullouts and trailheads along the Tioga Road, in Tuolumne Meadows, and in numerous subalpine meadows throughout the wilderness. Dandelion populations are treated manually or with aminopyralid above 7,000 feet to protect alpine communities. In the Andes Mountains of South America, an analog of the Sierra Nevada, dandelion has been shown to take over many mountain meadows. Below 7,000 feet, dandelion does not appear aggressive enough to merit treatment.

MEDIUM TO MEDIUM-LOW PRIORITY TREATMENT SPECIES

Most medium and medium-low priority species, both in the front country and at high elevation in the back country, are treated manually by staff and volunteers as they are encountered. Small dense populations might be targeted for herbicide application on a site by site basis. Examples of where herbicide is used for these species is where soil disturbance creates habitat for the spread of the species, such as in construction projects and in restoration sites. Volunteers help the invasive plant program manage a greater variety of species each year by manually removing many infestations that would otherwise go untreated (Table 1).

These non-native species are manually treated when encountered by crews and volunteers.

TABLE 1 MANUALLY TREATED INVASIVES

Species
Black mustard (<i>Brassica nigra</i>)
Field mustard (<i>Brassica rapa</i>)
Tocolote (<i>Centaurea melitensis</i>)
Foxglove (<i>Digitalis purpurea</i>)
Shortpod mustard (<i>Hirschfeldia incana</i>)
White sweet clover &
Yellow sweet clover (<i>Melilotus</i> spp.)
Spearmint (<i>Mentha spicata</i> var. <i>spicata</i>)
Many-flowered tobacco (<i>Nicotiana acuminata</i> var. <i>acuminata</i>)
London rocket (<i>Sisymbrium irio</i>)
Yellow salsify (<i>Tragopogon dubius</i>)
Common mullein (<i>Verbascum thapsus</i>)

EARLY DETECTION AND RAPID RESPONSE SPECIES

These non-native species have small populations and are present only in a few locations. Eradication is possible and highly desirable. Treatments of early detection species will include hand-pulling or herbicide if species are not effectively controlled with manual methods.

TABLE 2. EARLY DETECTION INVASIVE PLANTS

Species	Location
Jointed goatgrass (<i>Aegilops cylindrica</i>)	Rancheria
Barbed goatgrass (<i>Aegilops triuncialis</i>)	Big Oak Flat Rd. near Foresta
Common ragweed (<i>Ambrosia acanthicarpa</i>)	Valley Stables, Wawona Ranger Station
Redroot pigweed (<i>Amaranthus retroflexus</i>)	Yosemite Lodge
Common tarweed (<i>Centromadia pungens</i>)	Hennes Ridge
Rush skeletonweed (<i>Chondrilla juncea</i>)	El Portal Road
Poison hemlock (<i>Conium maculatum</i>)	Badger Pass
Portuguese broom (<i>Cytisus striatus</i>)	Old El Portal
Queen Anne's Lace (<i>Daucus carota</i>)	Rancheria
Dragonhead mint (<i>Dracocephalum parviflorum</i>)	Tuolumne Horse Campground
Mexican tea (<i>Dysphania ambrosioides</i>)	Old El Portal, Rancheria
Medusahead (<i>Elymus caput-medusae</i>)	El Portal, Foresta, Crane Flat Helibase, Ackerson Meadow
Broadleaf helleborine (<i>Epipactis helleborine</i>)	Ahwahnee Meadow, Cook's Meadow
Caper spurge (<i>Euphorbia lathyris</i>)	Old El Portal
Wall hawkweed (<i>Hieracium murorum</i>)	Tacoya Housing, Ahwahnee Hotel
Morning glory (<i>Ipomoea purpurea</i>)	Upper Pines Campground
Fluellin (<i>Kickxia spuria</i>)	NPS warehouse
Perennial pepperweed (<i>Lepidium latifolium</i>)	Foresta
Clasping pepperweed (<i>Lepidium perfoliatum</i>)	Tuolumne concession horse stables
Dalmatian toadflax (<i>Linaria dalmatica</i>)	Yosemite West
Hyssop loosestrife (<i>Lythrum hyssopifolia</i>)	Old El Portal
Alfalfa (<i>Medicago sativa</i>)	Tuolumne Horse Campground
Tree tobacco (<i>Nicotiana glauca</i>)	Old El Portal
Dallisgrass (<i>Paspalum dilatatum</i>)	Rancheria
Reed canary grass (<i>Phalaris arundinacea</i>)	Sentinel Meadow
American pokeweed (<i>Phytolacca americana</i>)	Old El Portal
Creeping buttercup (<i>Ranunculus repens</i>)	Wawona golf course
Russian thistle (<i>Salsola tragus</i>)	Ahwahnee Meadow, Sentinel Meadow
Shepherd's needle (<i>Scandix pecten-veneris</i>)	Old El Portal
Milk thistle (<i>Silybum marianum</i>)	Foresta, Incline Rd.
Indian hedge mustard (<i>Sisymbrium orientale</i>)	El Portal
Buffalobur nightshade (<i>Solanum rostratum</i>)	Badger Pass
Cutleaf nightshade (<i>Solanum triflorum</i>)	Valley stables, Curry Village
Johnson grass (<i>Sorghum halepense</i>)	Old El Portal, Rancheria, North Pines CG
Corn spurry (<i>Spergula arvensis</i>)	Tuolumne Horse Campground
Salt cedar (<i>Tamarix ramosissima</i>)	Grand Canyon of the Tuolumne
Fan weed (<i>Thlaspi arvense</i>)	Bridalveil Horse Campground
Crimson clover (<i>Trifolium incarnatum</i>)	Old El Portal
Seashore vervain (<i>Verbena litoralis</i>)	Rancheria

EARLY DETECTION AND TREATMENT SITES

Invasive plants require both propagules (seeds or rhizomes) and a vector (a person, piece of equipment, etc.) in order to spread and establish in new locations. Areas with both a high probability of species introduction and that have high traffic to other areas of the park are the highest priority for invasives early detection surveys and treatments.

Aggregate and soil piles are hot spots for invasive plant infestation. Some park operations require material, such as sand and gravel, to be brought in from outside Yosemite. The material is often staged before being distributed and used in multiple locations throughout the park.

The invasive plant program will survey all early detection and treatment sites listed in Table 3.



FIGURE 13 CONTAMINATED GRAVEL PILE HOSTING ITALIAN THISTLE

TABLE 3 LIST OF EARLY DETECTION AND TREATMENT SITES.

Crane Flat soil piles	Valley woodlot
El Portal woodlot	Wawona helispot
Foresta woodlot	Wawona horse camp
Gaylor pit	Wawona soil pile
Hetchy soil piles	May Lake pit
Hetchy stables	Tuolumne stables
Bridalveil horse camp	Valley stables
Tuolumne horse camp	South landing

TREATMENT PLAN BY GENERAL LOCATION

EL PORTAL TO YOSEMITE VALLEY (MAPS 1.0 – 1.11, 3.0 – 3.7)

Species	Timing	Treatments
Yellow star thistle	March-June	Spot spray (aminopyralid, glyphosate)
Jointed goatgrass	May-June, October-December	Spot spray (glyphosate, rimsulfuron) and handpull
Blackberry	August-December	Spot spray (glyphosate, imazapyr)
Black locust	April-December	Spot spray/Frill or cut stump (glyphosate, imazapyr, triclopyr)
French broom	May-July	Manual removal/Spot spray (aminopyralid)
Italian thistle	March-April	Spot spray (glyphosate, aminopyralid) and handpull
Giant reed	July	Manual removal/Spot spray (glyphosate)
Tree-of-heaven	October-December	Spot spray/Frill or cut stump (glyphosate, triclopyr)
Hops	March-July	Spot spray (triclopyr, imazapyr)
Johnson grass	March-November	Spot spray (glyphosate, imazapyr)
Perennial sweet pea	June	Spot spray (aminopyralid)
Rush skeletonweed	April-July	Spot spray (aminopyralid)

Yellow star-thistle is the greatest management concern in El Portal. **Italian thistle** is also targeted where it occurs around El Portal. The crew will survey all of El Portal and treat infestations of both species by herbicide application and may handpull small populations.

Blackberry treatment was initiated in many areas in El Portal in 2011 and will continue into future years. The IPP will notify residences prior to treatment in their yards. Crews will also continue to map and work with residents to remove remaining invasive species in the residential area such as **tree-of-heaven** and **French broom**.

Numerous **early detection species** are present throughout El Portal and are targeted for treatments with the goal of eradication. The single **Medusahead** population has likely been eradicated, with no future treatments necessary. This site will be monitored in 2023 and any individuals found will be handpulled. Crews will survey for and treat new populations found in the Ferguson Fire and impacts related to the fire such as handlines, drop points, and staging areas.

FORESTA & BIG MEADOW (MAP 2.3)

Species	Timing	Treatments
Spotted knapweed	May-August	Grid survey/hand-pull or spot spray (aminopyralid)
Yellow star-thistle	May-June	Grid survey/hand-pull or spot spray (aminopyralid)
Medusahead	April-June, October-December	Manual removal/Spot spray (glyphosate, rimsulfuron)
Blackberry	August-November	Spot spray (glyphosate, imazapyr)
Velvet grass	June-July	Herbicide study, spot spray (glyphosate, imazapyr)
Perennial pepperweed	June-August	Monitor, spot spray (glyphosate)
Italian thistle	April-May	Manual removal; spot spray (aminopyralid)
Oxeye daisy	June-August	Spot spray (aminopyralid)
Klamathweed	June-August	Spot spray (aminopyralid, glyphosate)

NPS crews have almost eradicated **spotted knapweed**, **perennial pepperweed**, **medusahead** **Italian thistle**, **milk thistle** and **yellow star-thistle** from the Foresta area. Crews will continue monitoring previously treated sites, surveying for new occurrences, and will document and treat any plants encountered.

Crews will spray **Himalayan blackberry**, most of which is at McCauley Ranch. Treatment will continue on **oxeye daisy** infestations throughout the Big Meadow area, with specific focus near developed areas and roads. Crews will hand-pull or shovel-shear **bull thistle** and spray larger populations with herbicide. Crews will survey for and treat **Klamathweed** and newly discovered populations of other early detection and medium-high priority species in the Ferguson Fire.

YOSEMITE VALLEY (MAPS 3.0-3.7)

Species	Timing	Treatments
Blackberry	August-November	Spot spray or cut and dab in traditional use areas (glyphosate, imazapyr)
Velvet grass	May-July, September-October	Manual removal with volunteers or spot spray (glyphosate)
Bull thistle	May-August	Shovel-shear, spot spray (aminopyralid)
Oxeye daisy	June-July	Map; spot spray (aminopyralid)
Klamathweed	June-August	Map; spot spray (aminopyralid, glyphosate)
Black locust	August-November	Cut stump, spot spray (glyphosate, triclopyr)

Hops	March-June	Spot spray (imazapyr)
Perennial sweet pea	June-July	Map new populations; spot spray (aminopyralid)
Russian thistle	May-August	Hand-pull, spot spray (glyphosate)
Wall hawkweed	June-August	Spot spray (aminopyralid)
Smooth brome, downy brome	June-August	Spot spray (glyphosate, rimsulfuron)

Herbicide treatment of **blackberry** in Yosemite Valley will continue. Volunteers will manually treat **bull thistle** in all wet meadows within Yosemite Valley after July 15th to avoid ground nesting birds. **Black locust** will be mapped and treated using the cut stump or basal bark treatment methods. All **hops** infestations will be treated with imazapyr. All **early detection** weed species will be monitored and treated as necessary. **Velvet grass** will be treated in some specific areas adjacent to disturbed areas, construction sites, or restoration sites. It will be thoroughly mapped and prioritized for possible future treatments elsewhere. Crews will continue to monitor, map, and treat a growing population of **biennial wild lettuce** in Tenaya Canyon if time allows.

WAWONA AND WAWONA ROAD (MAPS 5.0-5.7)

Species	Timing	Treatments
Blackberry	August-November	Spot spray (glyphosate, imazapyr)
Velvet grass	May-July	Spot spray (glyphosate)
Hops	March-July	Spot spray (imazapyr, triclopyr)
Klamathweed	June-August	Spot spray (aminopyralid)
Bull thistle	May-August	Shovel-shear, spot spray (aminopyralid)
Cheatgrass	April-June	Control (glyphosate) of isolated populations (incl. Henness Ridge)
Foxglove	June-July	Hand-pull, spot spray (glyphosate)
Perennial sweet pea	June-July	Map, spot spray (aminopyralid)
Rose campion	May-July	Hand-pull
Creeping buttercup	July-September	Hand-pull, spot spray (glyphosate)
Dalmatian toadflax	May-September	Spot spray (chlorsulfuron, imazapyr)
Broom species	May-July	Manual removal, cut stump (triclopyr)

The invasive plant crew will treat infestations of **blackberry** with glyphosate and work cooperatively with the concessionaire to treat the infestations near the Wawona golf course. The only known Yosemite population of **creeping buttercup** occurs along a creek adjacent to the golf course and will be retreated using an aquatic formulation of glyphosate. All non-landscape **hops** will be treated with imazapyr.

Velvet grass persists around the perimeter of Wawona Meadow and has a wide distribution in the area. Crews will treat velvet grass in key areas to reduce the risk of further spread, such as populations near the Wawona Horse Corral, along the Chilnualna

Falls trail and along the South Fork of the Merced River. Field staff will survey for new infestations in the Wawona Meadow restoration site and other areas.

Impacts from the Washburn fire in 2022 may also be present in the Wawona Meadow and Mariposa Grove areas. Targets include annual grasses and forbs, as well other high, medium, and early detection species to mitigate and stop invasive encroachment. Additional treatments will occur along restorative thinning project corridors in 2023.

Residential areas in Wawona are particularly diverse with non-native plants. Small populations of **French broom** and **Scotch broom** exist on both private and public land within the northern residential area. To address the invasive plants on private property, the IPP will continue outreach efforts, seeking cooperation and agreements to treat plants on private land.

Cheatgrass occurs at Henness Ridge (not shown in maps) where few other non-native plants are present. Crews will treat cheatgrass with glyphosate or rimsulfuron during the early season. **Dalmatian toadflax** was found escaping cultivation in Yosemite West. The IPP will work with the homeowner to treat this species with herbicide. If time allows, crews will treat isolated patches of **intermediate wheatgrass** along Wawona Road. Crews will survey for and treat new populations in the Ferguson Fire.

MARIPOSA GROVE (MAP 5.6)

Species	Timing	Treatments
Blackberry	August-October	Spot spray (glyphosate)
Bull thistle	May-August	Hand-pull, shovel-shear, spot spray (aminopyralid)
Common mullein	May-September	Hand-pull, shovel shear
Foxglove	May-September	Hand-pull, shovel shear
Italian thistle	May-June	Spot spray (aminopyralid)
Velvet grass	May-June & September-October	Spot spray twice yearly (glyphosate, imazapyr)

Invasive plant populations in the Mariposa Grove are a concern because of their potential to spread into more remote wilderness locations and their ability to compete against the numerous special status plant species there. Large infestations of **bull thistle** occur throughout the grove and were treated by volunteers from 2012 to 2017. Park staff will treat dense populations with aminopyralid while smaller more isolated patches will be manually treated with volunteer crews. Any non-native **blackberry** within the Mariposa Grove will be sprayed with glyphosate. **Velvet grass** within the grove will be mapped and treated with glyphosate. New invasive plant surveys will be conducted as a response to the Washburn fire in 2022. Survey and treatments for invasive plants will occur along fire suppression lines and points to help mitigate fire operations.

NORTHERN YOSEMITE (MAPS 6.0-6.12)

Species	Timing	Treatments
Blackberry	August-October	Spot spray (glyphosate)
Bull thistle	April-October	Spot spray (aminopyralid)
Klamathweed	June-August	Spot spray (aminopyralid)
Medusahead	April-June, October-December	Manual removal/Spot spray (glyphosate, aminopyralid, rimsulfuron)
Sweet Clover	June-August	Spot spray (aminopyralid)
Velvet grass	May-July & September-October	Survey and map, hand-pull, shovel-shear, spot spray (glyphosate, imazapyr)

Blackberry grows in dense patches along creeks below Lake Eleanor. These populations will continue to be monitored and treated in 2023. Crews will also treat **velvet grass** if time allows at Miguel Meadows.

Bull thistle, **sweet clover**, and **Klamathweed** will be targeted around the Big Oak Flat Entrance and Hodgdon Meadows where these species could spread by park operations or visitors. **Velvet grass** will be treated at Ackerson and Hodgdon Meadows, and at the Hetch Hetchy entrance station.

Medusahead will be targeted at Ackerson Meadow, which contains the largest population of this species in the park.

POOPENAUT VALLEY TO O'SHAUGHNESSY DAM (MAPS 6.3-6.4)

Species	Timing	Treatments
Blackberry	August-October	Spot spray (glyphosate)
Velvet grass	May-July	Survey and map, hand-pull, shovel-shear, spot spray (glyphosate, imazapyr)
Bull thistle	April-October	Spot spray (aminopyralid)
Klamathweed	June-August	Spot spray (aminopyralid)
Yellow star-thistle	April-August	Spot spray (aminopyralid), handpull

Blackberry grows along the Tuolumne River below Hetch-Hetchy. Additional surveys are needed to gain a complete understanding of the infestation in the most remote areas. Treatment of the lower Tuolumne and the populations just below O'Shaughnessy Dam are among the most complex projects undertaken by the IPP.

Crews will continue to treat the remainder of Klamathweed infestations along the Hetch Hetchy access road from Mather. **Velvet grass** is treated at the entrance station with glyphosate. Small, scattered populations of **bull thistle** are treated by hand-pulling and shovel-shearing when time allows. Aminopyralid may be used for large populations. Crews will monitor and treat any plants found at a staging area near the Hetch Hetchy stables where yellow star thistle, Italian thistle, and French broom have been found.

TUOLUMNE MEADOWS (MAPS 7.0-7.4)

Species	Timing	Treatments
Cheatgrass	May-June	Spot spray (glyphosate)
Dandelion	June-September	Spot spray (aminopyralid)
Smooth brome	June-September	Spot spray (glyphosate)
Clasping pepperweed	May-September	Hand-pull or spot spray (glyphosate, rimsulfuron)

Dandelion is by far the most widespread weed in Tuolumne and has undergone herbicide treatment since 2011 in select areas. Most sites will be treated manually to avoid impacts to amphibians. Some sites will not be treated manually or with herbicide to avoid any impacts to wildlife.

Early detection species such as high elevation **smooth brome** and **clasping pepperweed** will be retreated to work towards the goal of eradication. The highest amount of invasive plant diversity was found at Tuolumne stock use locations. At the Tuolumne horse campground, 24 different non-native plants were documented. This area can act as a propagule source for stock to transport invasive plants into the wilderness. All non-native plants found at the stables and horse campground will be treated.

Construction work at the Tuolumne Campground and along Tioga Rd. will continue in 2023. Lower priority species such as red sandspurry, polygonum spp., and annual bluegrass will be treated in and around areas where soil disturbance will occur.

GLACIER POINT ROAD (MAP 8.0-8.7)

Species	Timing	Treatments
Bitter Lettuce	June-July	Spot spray (aminopyralid), handpull
Bull thistle	April-October	Spot spray (aminopyralid), shovel shear
Cheatgrass	May-June	Spot spray (glyphosate)
Dandelion	June-September	Spot spray (aminopyralid)
Tansy mustard	June-July	Inflorescence removal, hand-pull

Dandelion and **bull thistle** occur in a few locations along Glacier Point Road and will be targeted. **Cheatgrass** occurs around the Glacier Point parking area and will be treated in 2023.

Construction work at Bridalveil Campground, Badger Pass, and Glacier Point Rd. will continue in 2023. Lower priority species such as red sandspurry, polygonum spp., and annual bluegrass will be treated in and around areas where soil disturbance will occur.

Tansy mustard, *Descurainia sophia* and **bitter lettuce** *Lactuca virosa* are two early detection species that occur in wilderness near Glacier Point Road. If time allows, these populations will be treated.

BIG OAK FLAT ROAD, CRANE FLAT, AND MERCED GROVE (MAPS 9.0-9.7)

Species	Timing	Treatments
Medusahead	April-June, October-December	Manual removal/Spot spray (glyphosate, aminopyralid, rimsulfuron)
Yellow star-thistle	May-June	Monitor/hand-pull or spot spray (aminopyralid)

Medusahead was discovered at the Crane Flat Helibase in 2014 and has been aggressively treated with a goal of eradication. The site will be monitored in 2023, if only a few individuals are found, they will be handpulled. If more is found than can be treated manually, they will be treated with either glyphosate or aminopyralid in spring depending on plant phenology. If the population size warrants, another treatment with rimsulfuron will follow fall rains and the next year's germination.

An isolated individual of **yellow star thistle** was found in 2021 at the helibase as well. That site will continue to be monitored in 2023. If few individuals are discovered, they will be handpulled. If a larger population is discovered, it will be treated with aminopyralid, though this is unlikely.

Construction work at Crane Flat Campground, will continue in 2023. Lower priority species such as sheep sorrel, red sandspurry, and polygonum spp. will be treated in and around areas where soil disturbance will occur.

Big Oak Flat Road will be surveyed for high priority invasive plants. If any are discovered, they will be treated.

WILDERNESS AREAS (MAPS 4.0-4.3, 6.2-6.3, 6.5-6.6, 6.10-6.11)

Species	Timing	Treatments
Blackberry	June-October	Spot spray or cut-and-dab (glyphosate, imazapyr)
Velvet grass	June-October	Hand-pull, or spot spray (glyphosate)
Bull thistle	June-September	Hand-pull, shovel-shear
Yellow salsify	June-September	Inflorescence removal, hand-pull
Common mullein	June-September	Hand-pull, shovel shear
Prickly lettuce	June-September	Hand-pull
Cheatgrass	June-September	Map, spot spray (rimsulfuron, glyphosate)
Dandelion	June-September	hand-pull or spot spray (aminopyralid)

Control of invasive plant populations in designated wilderness areas is a high priority. In the past, crews treated **blackberry** populations in remote locations by hand-pulling. Where infestations have not been eliminated with manual methods, crews will apply glyphosate. **Bull thistle** is the most abundant invasive species in Wilderness and has been removed manually or mechanically for decades.

An infestation of **velvet grass** was found at Merced Lake, 13 miles from the nearest road. As the most troubling and aggressive weed population within the Yosemite Wilderness, this infestation will be treated to prevent further spread into the backcountry. Along the Mist Trail, isolated populations of velvet grass will be handpulled. NPS crews and volunteers will continue to manually treat several other invasive species such as **common mullein** and **prickly lettuce** (*Lactuca serriola*) in remote Wilderness locations. **Dandelion** is a greater threat to subalpine and alpine communities than previously believed, some wilderness populations around Tuolumne Meadows will be treated in 2023.

Field staff and volunteers will continue to map **cheatgrass** in backcountry locations. Isolated populations that threaten Yosemite's wilderness areas will be hand-pulled. In 2014, a remote infestation of cheatgrass was found at Rodgers Lake. At about 20 miles from the nearest road. Patches of cheatgrass in the wilderness may be treated if time allows.

APPENDIX A: 2023 INVASIVE PLANT EARLY DETECTION WATCH LIST

This list is populated with species recognized by the state of California to be highly invasive weeds that are known to occur within 50 miles of Yosemite National Park. This list serves as a tool for managers to increase awareness of present and future threats; it is regularly checked, updated, and disseminated to IPP staff who remain vigilant to rapidly respond to any newly discovered occurrences. Distribution data are derived from CalFlora, the California Invasive Plant Council (Cal-IPC), and the California Consortium of Herbaria (CCH) records.

Species Scientific Name	Common Name	Cal-IPC Rating	C DFA Rating	Present in Park
<i>Acroptilon repens</i>	Russian knapweed	Moderate	B	No
<i>Aegilops cylindrica</i>	Jointed goatgrass		B	Yes
<i>Aegilops triuncialis</i>	Barb goatgrass	High	B	Yes
<i>Anthoxanthum odoratum</i>	Sweet vernal grass	Moderate	none	No
<i>Arundo donax</i>	Giant reed	High	none	Yes
<i>Brachypodium</i>	False brome	Moderate	none	No
<i>Brassica tournefortii</i>	Sahara mustard	High	none	No
<i>Centaurea diffusa</i>	Diffuse knapweed	Moderate	A	No
<i>Centaurea iberica</i>	Iberian star-thistle		A	No
<i>Centaurea stoebe</i>	Spotted knapweed	High	A	Yes
<i>Chondrilla juncea</i>	Rush skeletonweed	Moderate	A	Yes
<i>Cirsium arvense</i>	Canada thistle	Moderate	B	No
<i>Conium maculatum</i>	Poison hemlock	Moderate	none	Yes
<i>Cortaderia</i> spp.	Pampas grass	High	none	No
<i>Cynoglossum officinale</i>	Hound's tongue	Moderate	none	No
<i>Cytisus</i> spp.	Broom	Moderate-High	C	Yes
<i>Diurachia graveolens</i>	Stink wort	Moderate	none	No
<i>Elymus caput-medusae</i>	Medusahead	High	C	Yes
<i>Euphorbia oblongata</i>	Oblong spurge	Limited	B	No
<i>Euphorbia virgata</i>	Leafy spurge	High- ALERT	none	No
<i>Genista</i> spp.	Broom	High	C	Yes
<i>Glyceria declinata</i>	Low manna grass	Moderate	none	No
<i>Isatis tinctoria</i>	Dyer's woad	Moderate	B	No
<i>Lepidium chalepense</i>	Lens-podded hoary	Moderate-	none	No
<i>Lepidium latifolium</i>	Perennial pepperweed	High	B	No
<i>Linaria dalmatica</i>	Dalmatian toadflax	Moderate	A	No
<i>Linaria vulgaris</i>	Toadflax	Moderate	none	No
<i>Myriophyllum aquaticum</i>	Parrot's feather	High-Alert	none	No
<i>Myriophyllum spicatum</i>	Water milfoil	High	none	No
<i>Onopordum acanthium</i>	Scottish thistle	High	A	No
<i>Ranunculus repens</i>	Creeping buttercup	Limited	none	Yes
<i>Salsola tragus</i>	Russian thistle	Limited	C	Yes
<i>Sorghum halepense</i>	Johnson grass		C	Yes
<i>Spartium junceum</i>	Spanish lotus	High	none	No
<i>Stipa miliacea</i> var.	Smilo grass	Limited	none	No

<i>Tamarix</i> spp.	Tamarisk	High	none	Yes
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CALIFORNIA INVASIVE PLANT COUNCIL (CAL-IPC) RATINGS

Definitions of Cal-IPC weed ratings (California Invasive Plant Council 2006):

Each plant on the list received an overall rating of High, Moderate or Limited based on evaluation using the criteria system. The meaning of these overall ratings is described below. In addition to the overall ratings, specific combinations of section scores that indicate significant potential for invading new ecosystems triggers an **Alert** designation so that land managers may watch for range expansions.

High – These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

Moderate – These species have substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

Limited – These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.

CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE (CDFA) NOXIOUS WEED RATINGS

Definitions of CDFA Ratings (Schoenig 2005):

- **"A"** rated weeds are normally limited in distribution throughout the state. Eradication, containment, rejection or other holding action at the state-county level. Quarantine interceptions to be rejected or treated at any point in the state.
- **"B"** rated weeds are more wide spread. Eradication, containment, control or other holding action at the discretion of the commissioner. State endorsed holding action and eradication only when found in a nursery.
- **"C"** rated weeds are generally widespread throughout the state. Action to retard spread outside of nurseries at the discretion of the commissioner. Reject only when found in crop seed for planting or at the discretion of the commissioner.

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