INVASIVE PLANT MANAGEMENT PROGRAM
2010 WORK PLAN

HIGHLIGHTS OF 2009

Full implementation of the 2008 Yosemite National Park Invasive Plant Management Plan (IPMP) began in 2009. The IPMP is a comprehensive plan that encompasses prioritization, early detection, prevention, control, monitoring, ecological restoration, research, and outreach. The 2009 efforts emphasized treatment of species ranked as high-priority, followed by those of medium-high priority. These priority levels are explained in detail in the IPMP (www.nps.gov/yose/parkmgmt/invasive.htm). Among high-priority species, much of the 2009 treatment efforts were directed toward species with large populations within the park. For the first time in many years, invasive plant managers were able to use two herbicides: glyphosate and aminopyralid, as additional tools to control priority infestations that had been long neglected because they could not be addressed effectively with only manual tools.

Between April and June dozens of staff members surveyed 629 acres for yellow star-thistle on the steep slopes in El Portal. Because of the wet spring, much more star-thistle than normal germinated. Some 26 gross-infested acres were mapped with, on average, 70% star-thistle cover.

Crews treated 21 acres (81%) before the remainder set seed. In Yosemite Valley, crews and volunteers surveyed and treated 70 acres of Himalayan blackberry and cut-leaf blackberry (*Rubus discolor* and *R. laciniatus,* collectively referred to as "blackberry"). Our most widespread high-priority species in Yosemite, 75 gross-infested acres of bull-thistle (*Cirsium vulgare*) were treated in Yosemite Valley, Wawona and in the North Mountain burn area. Biologists initiated an herbicide effectiveness study to evaluate the use of glyphosate to control velvet grass (*Holcus lanatus*). This species is present in hundreds of acres of valuable meadows in Yosemite, and manual control methods have not been successful. The results of this study will aid in the development of a management strategy. Several days of intense surveying lead crews to locate and remove 19 spotted knapweed plants in Foresta.

OVERVIEW OF 2010 WORK PLAN

The focus of the 2010 plan is similar to the 2009 plan in that we will first target priority species and, as time allows, medium-high priority species. Because we expect some re-growth after treatment, we will revisit all sites previously treated to monitor and retreat. In addition, we plan to intensify our control of velvet grass, initiate an herbicide effectiveness experiment focused on cheatgrass (*Bromus tectorum*), initiate local treatments of cheatgrass, and extend blackberry control operations to places we did not reach in 2009. Areas in which herbicide application is taking place will be signed conforming to herbicide label requirements. Signs will clarify which type of herbicide is in use, the target species, time of application, scope of treated area, re-entry time if applicable, and contact information. The treatment method for a particular locality depends on the invasive species, plant phenology (timing of plant growth, flowering, and senescence [aging]), the availability of methods known to be effective and permitted under the IPMP, and a range of site specific considerations:

Location	Treatment
Within the bed and banks of a designated Wild and Scenic River	Manual methods only
Wetland ecosystems	In consultation with Branch of Wildlife Management No herbicide use within 10 feet of standing or flowing water
Terrestrial ecosystems	Herbicide for Himalayan blackberry, other species herbicide if population size exceeds threshold in IPMP
Archeological sites	In consultation with Branch of Anthropology and Archeology
Traditional-use areas	In consultation with tribes
Wilderness areas	Manual methods, or herbicide if ecosystem is threatened
Private in-holdings	No treatment

Consistent with Yosemite's Invasive Plant Management Plan, there will be ongoing internal consultation with other branches in the Division of Resources Management and Science as well as external consultation with American Indian tribes and groups. With the input of these parties, an appropriate treatment plan will be selected.

The work plan by definition addresses Yosemite's most serious, known invasive plant populations. Through ongoing survey efforts, new invasive plant locations are found frequently. We will continue to conduct early detection and rapid response work throughout Yosemite, consistent with the IPMP, to minimize the risk of further spread.

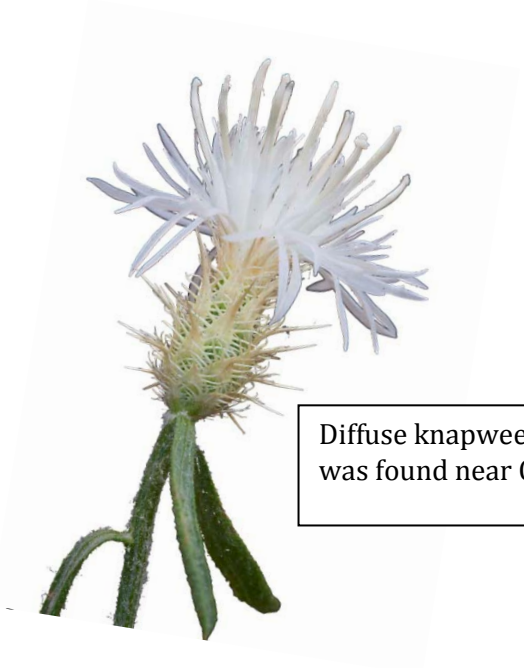
List of terms

Treatment techniques

Spray	herbicide is applied to foliage of target plant using a backpacker sprayer or a truck-mounted sprayer
Frill cut	used on trees or large shrubs, a diagonal cut into the bark is first made to aid the delivery of herbicide into the plant
Stump cut	used on trees, a tree is cut near ground level before herbicide is applied directly to the stump
Hand-pull	removal of 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
Shovel-shear	plant is severed a couple inches under the ground surface using a shovel; some root material remains
Inflorescence removal	The reproductive parts are removed to prevent spread by seed
Cut and dab	plant is lopped a few inches from ground before using a paint brush to apply herbicide to the stub

Monitoring activities

Survey	a systematic search for target plants
Grid survey	a line of people collectively search for target plants to thoroughly survey an area
Map	document infestations; most often using GPS units
GPS	Global Positioning System; use of satellite technology to pinpoint location; used to map infestations
Monitor	a general term to describe all activities that examine results of treatments; may be observing a site after treatment or an in-depth scientific study
Pilot study	a quantitative study to assess effectiveness of a treatment new to Yosemite



Diffuse knapweed (*Centaurea diffusa*) was found near Cascade Creek in 2009.

El Portal to Pohono Bridge

Species	Timing	Treatments
Yellow star-thistle	March-June	Spray (aminopyralid or glyphosate)
	May-June	Grid survey/hand-pull
Himalayan blackberry	August-October	Spray (glyphosate)
Velvet grass	May-July	Map infestations
Tree-of-heaven	September	Spray/Frill or stump cut (glyphosate)
Perennial sweet pea	June	Spray (aminopyralid or glyphosate)

Yellow star-thistle (YST) is still the IPMP's greatest management concern in El Portal. In 2009, we sprayed all remaining large, dense stands except for one. This year, we plan to retreat these stands with herbicide and treat the last remaining dense stand. We will also rigorously grid search all YST habitat and hand-pull where in low density. Where convenient, tocolote (*Centaurea melitensis*) will be treated the same as YST (inset).

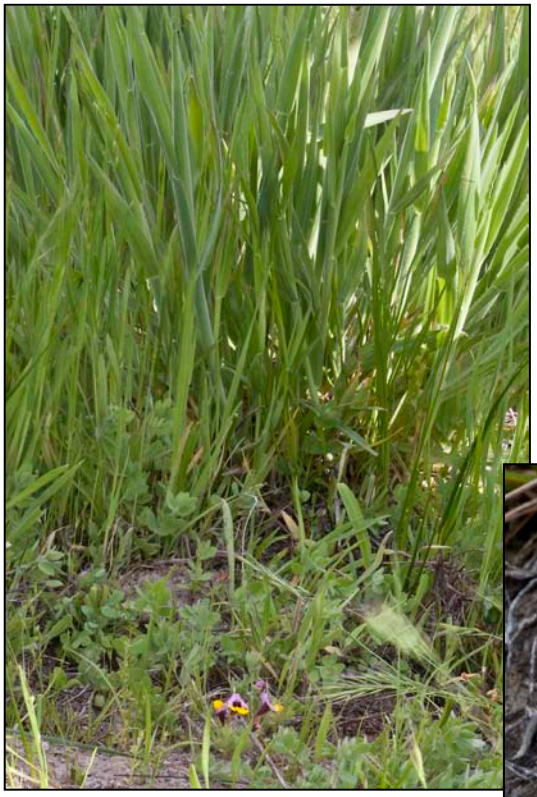
Himalayan blackberry is also a high priority invasive species in this work. We will extend our treatments from the Pohono Bridge down to the Yosemite View Lodge, outside the bed and banks of the Merced River. Blackberry treatments from the Yosemite View lodge to the El Portal Road will be delayed until 2012. West of El Portal Road we hope to begin treatments in 2010. Tree-of-heaven is common in El Portal, much of it near homes. At homeowner's request, NPS will treat this and other high-priority species in the residential area. As time permits, National Park Service (NPS) crews will also remove medium-high priority species (e.g. yellow sweet clover, rose clover and black mustard) with manual and mechanical methods as in the past. Crews will survey for new populations of non-native invasive plants.

Foresta

Species	Timing	Treatments
Spotted knapweed	June-July	Grid survey/hand-pull
Yellow star-thistle	May-June	Grid survey/hand-pull
Perennial pepperweed	June-July	Grid survey/hand-pull
Himalayan blackberry	August-October	Spray (glyphosate)
Velvet grass	May-July	Spray (glyphosate)
Perennial sweet pea	April-July	Spray (glyphosate, aminopyralid)
Cheatgrass	Feb-Oct	Pilot herbicide use (glyphosate, aminopyralid)
Ox-eye daisy	May-July	Spray (aminopyralid)

Invasive Plant Management Program 2010 season goals for this work zone:
In Foresta, NPS crews and volunteers have treated spotted knapweed (inset), perennial pepperweed and yellow star-thistle to an extent that they have been nearly eradicated. We will continue surveying for these species and will document and hand-pull any plants encountered. Himalayan blackberry will be remapped and sprayed. Crews will survey for new populations of non-native invasive plants.

We will be continuing a pilot study initiated last year in Big Meadow to test the effects of herbicide on velvet grass. If study results are positive, we will proceed to treat velvet grass in the remainder of the meadow where hydrologic conditions permit and cover is less than 50%. As in past years, we will hand-pull or shovel-shear bull-thistle. We will be initiating a study on control methods for cheatgrass (*Bromus tectorum*). We will be testing glyphosate and aminopyralid in the spring and aminopyralid as a pre-emergent herbicide in the fall 2010. Additionally, we will survey for and treat high and med-high priority species found in the Big Meadow burn area and areas impacted by fire suppression activity.



WEED FACT: One of our high priority plants, the exotic velvet grass (*Holcus lanatus*), towers over the rare yellow-lip pansy monkeyflower (*Mimulus pulchellus*) in Big Meadow on May 25th, 2009 (see foreground and inset below).

Velvet grass forms a thick thatch and if left untreated it poses a clear threat to open mineral soil inhabiting plants such as the pansy monkey flower.

The pansy monkey flower is a Yosemite National Park special status species. It is also listed by the California Native Plant Society as category 1B.2: "plants rare, threatened or endangered in California with a moderate immediacy of threat." It is endemic to California State, found only in three Sierra Nevada counties (Calaveras, Mariposa, Tuolumne).

Wawona

Species	Timing	Treatments
Blackberry	August-October	Spray (glyphosate)
Velvet grass	May-July	Spray (glyphosate)
Bull-thistle	May-August	Shovel-shear, spray (glyphosate)
Foxglove	June-July	Hand-pull
Everlasting pea	June-July	Map; Spray (aminopyralid)
Cheatgrass	March-October	Map; Pilot herbicide study

In 2009, the Wawona work crew successfully remapped bull-thistle, velvet grass and blackberry. The majority of blackberry and bull-thistle were treated. We will retreat all bull-thistle and blackberry infestations with the same methods employed in 2009. Velvet grass persists around the perimeter of Wawona Meadow and is a high priority for treatment. We will be continuing a pilot study initiated last year in Wawona Meadow to test the effects of herbicide on velvet grass. If study results are positive, we will proceed to treat velvet grass in remainder of meadow where hydrologic conditions permit and cover is less than 50%. Additionally, we will hand-pull velvet grass in key areas to reduce the risk of further spread, such as those along the Chilnualna Falls trail and along the South Fork of the Merced River.

For 2010 we will remap cheatgrass, perennial sweet pea and foxglove. To address the invasive plants on private property, we will begin outreach and seek agreements to treat plants on private land.

There are several native thistle species in Yosemite. Bull thistle is easily differentiated by its warty leaf surface. Our native thistles have smooth leaf surfaces.

Mariposa Grove

Species	Timing	Treatments
Himalayan blackberry	August-October	Spray (glyphosate)
Bull-thistle	May-August	Hand-pull, shovel-shear, spray (glyphosate)
Common mullein	May-September	Hand-pull

Invasive plant populations in the Mariposa Grove are a priority because of their potential to spread into more remote wilderness locations. Last year, priority species were remapped in Mariposa Grove and nearly all populations were treated. We will retreat infestations in the same manner as last year: blackberry and dense patches of bull-thistle (large populations found outside of wilderness areas) will be sprayed with herbicide. In wilderness, we will shovel-shear bull-thistle. NPS crews and volunteers will hand-pull common mullein and shovel-shear bull-thistle as in past years.

Yosemite Valley

Species	Timing	Treatments
Himalayan blackberry	August-October	Spray (glyphosate) and lop and grub
Velvet grass	May-July	Spray (glyphosate)
Bull-thistle	May-August	Shovel-shear, spray (glyphosate)
White clover	April-June	Hand-pull
Black locust	August-October	Herbicide (glyphosate)
Klamath weed	July-August	Map
Virginia creeper	July-September	Map
Hops	June-August	Spray (glyphosate)
Cheatgrass	April-October	Map

Invasive plant crews mapped the 2009 extent of blackberry and bull-thistle in this region. The majority was treated with herbicide, although there were some volunteer-assisted operations. Anticipated regrowth will be treated with glyphosate until full control is attained. Follow-up treatments for bull-thistle were also treated manually, often with volunteer help, or sprayed when patches were dense. Velvet grass (inset) is abundant in Yosemite Valley and is a high priority for treatment but has not yet been accurately mapped. We hope to find volunteer help with this task. We will be continuing a pilot study initiated last year in Tenaya Creek Canyon to test the effects of herbicide on velvet grass. If study results are positive, we will proceed to treat velvet grass in the remainder of Tenaya Canyon where hydrologic conditions permit and cover is less than 50%. We do not have a comprehensive treatment plan for cheatgrass at this time—for 2010 we will document its

distribution, resources permitting. Some medium-high priority species will also be targeted. Black locust populations will be mapped and treated with a cut-stump approach. Crews sprayed hops with glyphosate last year and will treat regrowth. Experienced botanists will conduct plant surveys to detect any new non-native species entering the park.

WEED FACT: Native animals are adapted to feed on native plants—with some animals very selective in the plants they eat—and to occupy well-defined plant habitats. Non-native plants can infest an area to the degree that food sources are displaced, resulting in adverse effects on wildlife. Conversely, some non-native plants can provide unnatural food abundance, affecting the distribution and behavior of animals. Thickets of Himalayan blackberry, for example, cover about 80 acres of Yosemite Valley, and their berries attract black bears into areas where they are more likely to have confrontations with humans, which can be dangerous for both species.

Wilderness Areas

Species	Timing	Treatments
Himalayan blackberry	June-September	Hand-pull, cut and dab (glyphosate)
Velvet grass	June-September	Map, spray (glyphosate), hand-pull, inflorescence removal
Bull-thistle	June-September	Hand-pull, shovel-shear
Yellow salsify	June-September	Inflorescence removal
Common mullein	June-September	Hand-pull
Prickly lettuce	June-September	Hand-pull
Cheatgrass	June-September	Hand-pull

Control of current invasive populations in designated wilderness areas is a very high priority for the Invasive Plant Management Program. NPS crews will manage most Himalayan blackberry populations in remote locations by hand-pulling while some locations may be treated with herbicide. We will focus our velvet grass treatments on preventing further spread into remote areas. Options for managing large velvet grass and other species infestations in Pate Valley are being explored. NPS crews and volunteers will continue to manually treat several other invasive species such as yellow salsify, common mullein and prickly lettuce as they have been in previous years. We will also initiate an effort to document the cheatgrass in Yosemite's remote areas, most of which are wilderness, and hand-pull isolated populations that threaten our most pristine wilderness areas.

O'Shaughnessy Dam to Poopenaut Valley

Species	Timing	Treatments
Himalayan blackberry	August-October	Survey and map; herbicide (glyphosate)
Velvet grass	May-July	Survey and map
Bull-thistle	April-October	Hand-pull, shovel-shear, spray (glyphosate)

Last year, biologists documented blackberry and other invasive plants along the Tuolumne River below Hetch-Hetchy. Additional surveying will be needed to complete the mapping. Blackberry outside the bed and banks of the Tuolumne River and at least 10 feet from standing water should be sprayed with glyphosate resources permitting. To mitigate the threat of further spread of blackberry within the bed and banks of the river, crews may use manual methods to mitigate seed production in more accessible areas. We will treat bull-thistle as in past years by hand-pulling and shovel-shearing as well as with herbicide in dense patches.

Right: the upstream-most blackberry patch will be difficult to control!

TREATMENT PLAN FOR HIGH-PRIORITY SPECIES

Cheatgrass (*Bromus tectorum)*
This plant is widespread in Yosemite and difficult to control. We had not focused control efforts toward cheatgrass in the past but this year we are initiating a pilot herbicide study. We will also document its distribution in the park and target some treatments to slow spread farther into the wilderness.

Italian thistle (*Carduus pycnocephalus*)
This California State listed noxious weed has been found a few times in Yosemite and it is effectively treated with manual methods wherever it is found. Active monitoring is conducted in April and May in El Portal (inset).

Spotted knapweed (*Centaurea maculosa*)
Since accidental introduction to Foresta in 1990, park staff has repeatedly hand-pulled spotted knapweed with the goal of eradicating it from Yosemite. Crews will search previously infested areas; individual plants will be hand-pulled. Large patches are not known or expected, but will be sprayed with aminopyralid if necessary.

Yellow star-thistle (*Centaurea solstitialis*)
In El Portal, aminopyralid will be used Mar-Apr to treat populations larger than 10 square meters. If needed, glyphosate may be used to spot spray plants with backpack sprayers later in the season (Apr-June), or in case new populations are discovered. Four large populations of yellow star-thistle and tocolote (*C. melitensis*) remain in El Portal on steep hillsides. In Foresta, aminopyralid will be used between Apr-May. Elsewhere in El Portal, extensive grid surveys have been conducted in El Portal, and have been maintained and will continue to be maintained using manual and mechanical methods.

Bull-thistle (*Cirsium vulgare*)
Bull-thistle is wind dispersed and quickly invades moist habitats after disturbance. After prescribed and wildland fires, crew often find many new locations and bull-thistle is presently our most widespread high priority invasive plant. It is unlikely that all populations can be treated in 2010. NPS crew will remove bull-thistle where encountered with manual and mechanical methods, unless populations are denser than 10 individuals per square meter. In such cases crews will spray with the herbicide glyphosate outside of designated wilderness.

French broom *(Genista monspessulana)*
This plant was introduced to El Portal as an ornamental and is spreading quickly. It is treated where encountered on NPS land, but it is present in several yards in El Portal. Other broom species (*Genista* and *Cytisus*) are present in in-holdings within Yosemite and some of them may be invasive. Public outreach materials and activities are being developed to reach these landowners.

Velvet grass (*Holcus lanatus*)
Herbicide treatment will focus on small populations that are surrounded by intact native plant communities to halt further impact to the native vegetation. The surrounding community will be deemed an intact native plant community when the assemblage of plants is mostly native and is representative of that habitat. Additionally, small populations found along roads and trails with a high likelihood of dispersal into natural habitats will be a main target.

Perennial pepperweed (*Lepidium latifolium*)
This species was documented and eradicated in Foresta but monitoring is ongoing.

Himalayan blackberry (*Rubus discolor*) and cut-leaf blackberry (*Rubus laciniatus*)
Himalayan blackberry constitutes the majority of invasive blackberry; cutleaf blackberry will be treated the same as Himalayan blackberry. NPS crews will treat with aminopyralid and glyphosate. Early season treatments have not yielded encouraging results elsewhere, and experimental June-July treatments are needed to narrow down the optimal treatment window to begin treatments in Yosemite specifically. Treatment will be applied with backpack sprayers or with a hand wand from a truck mounted sprayer. In the Poopenaut Valley we will try a cut – dab technique with glyphosate if trial conducted in 2009 yield encouraging results. We will spot-spray using backpack sprayers if the cut- dab techniques are not highly effective.

TREATMENT PLAN FOR MEDIUM-HIGH PRIORITY SPECIES

Tree-of-heaven (*Ailanthus altissima*)
Tree-of-Heaven's known distribution in Yosemite is confined to El Portal and Yosemite Valley (Ansel Adams Gallery). This species is particularly difficult to control through manual and mechanical methods because it easily resprouts from remaining underground fragments. Therefore, we will frill-cut, stump-treat, or spray foliage of small plants as appropriate to eliminate plants in Old El Portal. Many plants are located near homes so public outreach materials and activities are being developed to reach El Portal residents. NPS crew will be available to help homeowners eradicate this species.

Prostrate pigweed (*Amaranthus albus*)
Scattered prostrate pigweed individuals are documented in El Portal, Wawona and Yosemite Valley. Crews may hand-pull prostrate pigweed when encountered.

Giant reed (*Arundo donax*)
The giant reed is a widespread problem in California but populations in Yosemite are limited to residential areas in El Portal. We plan to eradicate this species with herbicide treatment if manual and mechanical methods do not work.

Black, field, and shortpod mustards (*Brassica nigra, B. rapa, and Hirshfeldia incana*)
Several mustard species are located along roadsides. Crews will hand-pull these species as in past years.

Bermuda grass (*Cynodon dactyon)*
In Yosemite Valley, Bermuda grass is present only near Ahwahnee cabins, and along the roadside west of the Rangers' Club. We will survey these locations and then determine best treatment options.

Foxglove (*Digitalis purpurea)*
This invasive has been and will continue to be controlled by hand-pulling in Wawona, Yosemite Valley and Hodgdon.

English ivy (*Hedera helix*)
English ivy is known in the park but not well documented. We will map all known sites in Yosemite Valley and El Portal.

Hops (*Humulus lupulus*)
Hops is present in Carlon and several sites in Yosemite Valley. We treated Yosemite Valley populations with glyphosate and plan to apply follow-up treatments.

Klamath weed (*Hypericum perforatum*)
Yosemite National Park has controlled Klamath weed by repeated hand-pulling and by means of a biocontrol in the past. Hand-pulling will continue but since it is a rhizomatous species, it is not particularly effective in eradicating populations. Hand-pulling along several roadways has been abandoned because of safety concerns. Large populations and populations along busy roadways will be sprayed using glyphosate. Klamath weed is very similar to the native *H. formosum*, but the native species lacks the characteristic translucent glandular dots when held up to the light (photo on right)

Perennial sweet pea (*Lathyrus latifolius*)
Perennial sweet pea (or everlasting pea) escaped cultivation and now grows in El Portal, Yosemite Valley and Foresta. It is very difficult to control through manual or mechanical methods. Therefore, we will treat with herbicide.

Ox-eye daisy (*Leucanthemum vulgare*)
Ox-eye daisy is widely established along roadsides in El Portal, Foresta, Yosemite Valley, and Wawona. Its distribution needs to be documented first. Following this, the effectiveness of manual control methods needs to be established. Disturbance due to fuel reduction treatment sites in Foresta may increase the population and, if so, herbicide treatments may be necessary.

Rose campion (*Lychnis coronaria*)
We will map known locations of rose campion and survey for new populations.

White sweetclover (*Melilotus alba*), yellow sweetclover (*M. officinalis*) and sourclover (*M. indica*)
Invasive *Melilotus* species are currently known from Hodgdon, El Portal road, Big Oak Flat Road, Hetch Hetchy (sourclover), Camp 6 (white), and El Portal (yellow). These invasive plants have been and will continue to be controlled by hand-pulling.

Spearmint *(Mentha spicata* var*. spicata)*
Known populations of spearmint exist in Wawona and a couple sites in Yosemite Valley. Populations may be hand-pulled.

Many flower tobacco (*Nicotiana acuminata* var. *multiflora*)
Many flower tobacco is found in Wawona, the Mariposa Grove and Yosemite Valley. Plants may be hand-pulled.

Woodbine (Virginia creeper, *Parthenocissus vitacea*)
Park and volunteer crews will hand-pull Virginia creeper populations in Yosemite Valley. We will survey for other populations.

Black Locust (*Robinia pseudoacacia*)
Yosemite Valley black locust populations are spreading and have been found as far downriver as the Rostrum. Populations will be mapped and treated with a cut-stump approach.

London Rocket (*Sisymbrium irio*)
We will map known populations of London rocket and survey for new populations.

Rose Clover (*Trifolium hirtum*)
We will map the rose clover population above Cascades Fall (Route 140), those in Wawona and survey for additional populations. Crews will continue to hand-pull as in past years.

Common mullein (*Verbascum thapsus*)
This invasive plant has been controlled throughout Yosemite by means of manual methods, which will be continued.

Vetch (*Vicia benghalensis s.l.*)
We will map known locations of vetch and survey for new populations.

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