

California Native Plant Society

North Coast Chapter
P.O. Box 1067
Arcata, CA 95518
December 29, 2009

Katy Coba, Director
Oregon Dept. of Agriculture
635 Capitol St. NE
Salem, Oregon 97301-2532
kcoba@oda.state.or.us

Re: Proposed Amendment to the Oregon Noxious Weed Quarantine (603-052-1200) adding two "A" list species commonly known as yellowtuft (*Alyssum corsicum* and *A. murale*).

Dear Director Coba,

These comments are submitted on behalf of the California Native Plant Society (CNPS). CNPS is a statewide nonprofit organization of nearly 10,000 amateurs and professionals dedicated to the preservation of California's diverse flora. CNPS conducts a variety of conservation efforts focused on long-term protection and preservation of native flora in its natural habitat, and is the foremost non-governmental organization working to protect rare, threatened, and endangered plants and sensitive plant communities in California. The North Coast Chapter represents approximately 300 members in Del Norte, Humboldt, Trinity, and western Siskiyou Counties.

We strongly support the proposed addition of yellowtuft, *Alyssum corsicum* and *Alyssum murale*, to the state quarantine list. These two European species pose a serious threat to sensitive serpentine habitats in southwest Oregon and northwest California, thereby threatening dozens of rare, threatened, and endangered plant species. These species are of particular concern due to their natural ability to thrive on serpentine soils.

Yellowtuft has recently begun invading sensitive serpentine areas on public lands in Josephine County, along the California border. These two species were introduced several years ago with the intent of mining nickel by exploiting the plants' ability to hyperaccumulate naturally-occurring metals from the soil. These plants have escaped into the Wild and Scenic Illinois River corridor, and into the BLM and USFS Rough and Ready Botanical Areas and other public lands, including habitat of the federally-listed endangered Cook's desert parsley (*Lomatium cookii*).

Since *Alyssum murale* is likely to thrive on non-serpentine soils, agricultural lands in southwest Oregon and northwest California are also threatened. Additionally, toxicity to livestock and wildlife are likely, since hyperaccumulators are highly toxic to herbivores, though the palatability of these species is apparently unknown.



Dedicated to the preservation of California native Flora

We are particularly concerned about the potential spread of these invasive species to the sensitive serpentine areas of Del Norte County, which is known for its botanical uniqueness. The Smith River National Recreation Area is particularly at risk due to the network of dirt roads crossing the Oregon-California border. These roads are regularly used by off-highway vehicle (OHV) drivers who access the Smith River National Recreation Area from areas in Oregon where roadside populations of *Alyssum* have already been documented just miles from the California border. Since the seeds are known to spread on vehicle tires and equipment, as well as by water and wind, the continued uncontrolled expansion of infestations is highly likely.¹

Since the two *Alyssum* species have the potential to outcompete native flora on serpentine substrates, with a moderate probability of introduction through human activities, they were ranked as "A" list noxious weeds using both the modified USDA-APHIS Risk Assessment and the Oregon Department of Agriculture Noxious Weed Rating System.² Despite quickly listing the species, a few factors will complicate eradication efforts and create a need for intensive ODA effort over the next 2 to 5 years. One, the species are considered difficult to control, and two, the *Alyssum* fields are on county and private lands under a variety of ownerships, in many cases directly bordering BLM and USFS lands. Land ownership issues and agency restrictions both contribute to the complexity of eliminating these species. ODA can play a critical role in coordinating with landowners where eliminating the crops will be essential to eradication efforts. Although eradication of these species from Oregon will not be easy, we hope ODA will highly prioritize this work due the serious threat posed to public lands, Threatened and Endangered plants, livestock and wildlife.

The Klamath-Siskiyou Mountains of northwest California and southwest Oregon contain the largest serpentine area in North America. The region is a world-renowned center of diversity and endemism, with species and unique plant communities that occur nowhere else in the world, including the federally-listed endangered McDonald's rock-cress (*Arabis macdonaldiana*).

Much of the area's diversity is attributed to the extensive serpentine landscapes and the endemic species they support. Local tourism is supported by the unique serpentine habitats, as is scientific study and appreciation of natural history. It should be a top priority to eradicate these noxious weeds before they escape into other sensitive serpentine or agricultural soils in the Kalmiopsis Wilderness, the Smith River National Recreation Area, and other areas in northwest California.

We appreciate the Department's swift action to control these noxious weeds, and also appreciate the opportunity to comment on the proposed addition to the state quarantine list.

Sincerely,

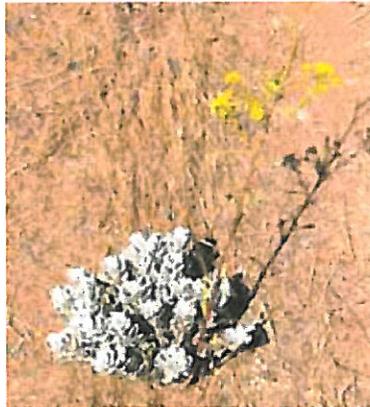


Jennifer Kalt, Conservation Chair
North Coast Chapter, California Native Plant Society

¹ K. Amsberry, M. Jules, and R. J. Meinke. December 5, 2008. Pest Risk Assessment of *Alyssum murale* and *A. corsicum*. Oregon Department of Agriculture and United States Forest Service.

² Ibid.

Pest Risk Assessment of *Alyssum murale* and *A. corsicum*



**Prepared by Kelly Amsberry (ODA),
Maureen Jules (USFS)
and Robert J. Meinke (ODA)**

December 5, 2008

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Identity: *Alyssum murale* and *Alyssum corsicum*

Family: Brassicaceae

Common name: yellowtuft

Introduction

Phytomining

Promoted as an environmentally conscious method for cleaning up contaminated mining sites, phytoremediation consists of planting hyperaccumulators (plants with the ability to extract metals from the soil and concentrate them in stems, shoots and leaves) on mine wastes. Once plants are mature, they are harvested and burned. The metallic ash is processed to produce usable metals, and the concentrations of toxic elements in the contaminated soils eventually decrease. *Alyssum murale* (Brassicaceae), a native of eastern European serpentine soils, is one of the most studied of these hyperaccumulator plants (Figure 1).

This perennial, yellow-flowered mustard has been used successfully in several locations in Canada to reduce toxic levels of nickel from mine waste, while also providing a source of ore for a nearby smelter (Strauss 2002).

In the late 1990's, the proposed uses of *Alyssum murale* were expanded to include not only phytoremediation (decontamination of mine wastes), but phytomining, the removal of metals from naturally occurring mineral soils. Oregon State University Extension Service evaluated use of this plant as a new farm crop in 2002, and indicated that neither *A. murale* nor the related



Figure 1. A specimen of *A. murale* in flower at the Seats Dam site in 2007. (Photo by K. Amsberry.)

A. corsicum had the potential to spread “across the serpentine landscape in an uncontrolled manner.” (Roseburg 2003). Based on this assessment, the risk of this exotic species invading natural areas and outcompeting native species was deemed minimal, and planning for cultivation of the new crop continued. The following year, Texas-based Viridian Resources sowed *A. murale* and *A. corsicum* seed at several serpentine sites in Josephine County, including fields located immediately adjacent to the floristically diverse Rough and Ready Botanical Area, and managed by the Illinois Valley Airport.

The Illinois Valley

The Illinois Valley contains the greatest concentration of serpentine soils in Oregon, and supports a diverse and unique flora. Fifteen plant taxa with conservation status (listed as rare, threatened or endangered by Oregon Department of Agriculture, U.S. Fish and Wildlife Service or Oregon Natural Heritage Information Center) occur in this area, including two species federally listed as endangered

(Figure 2). Several additional species, although rare, have not required conservation status due to the lack of documented threats to their viability. The unsuitability of the harsh serpentine habitat to farming and development - and the resistance of these areas to weed invasions - has allowed these rare edaphic

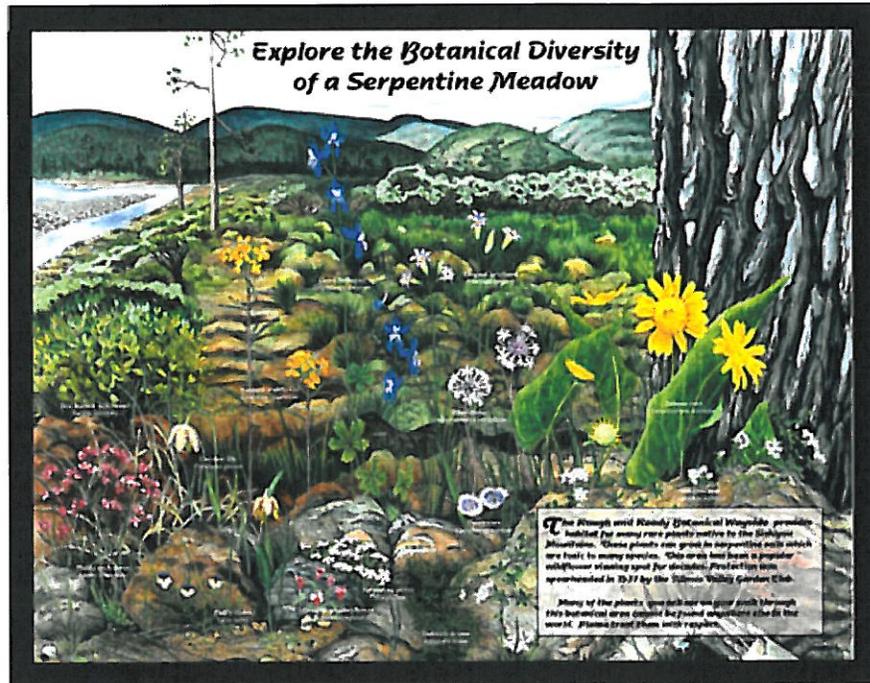


Figure 2. A depiction of Rough and Ready Botanical Area by Oregon artist Paula Fong. This poster is sold at local gift shops in Josephine County.

endemics present to flourish undisturbed. The beauty and uniqueness of the Illinois Valley flora ranks with that of other serpentine based biodiversity “hotspots” throughout the world (such as those in New Caledonia, South Africa, Cuba and California), and the potential contribution of these

wildflower areas to tourism are recognized by local tourism promoters

(<http://www.southernoregon.org/cities/illinoisvalley.html>,

<http://www.cavejunction.com/cavejunction/areainfo.shtml>, <http://www.stagestopdrive.com/area.asp>).

Cultivation and spread

Despite Viridian's statements in Josephine County's lease agreement for the County-managed airport site that plants would be harvested prior to flowering (thus preventing seed dispersal), harvest did not occur as scheduled, and the cultivated airport fields were soon covered with a sea of bright yellow flowers. By 2005, local citizens reported observing *A. murale* far from cultivated fields, and land managers were becoming skeptical of early assertions regarding the inability of this species to invade Josephine County's botanically rich serpentine areas. Harvested and baled plants continued to release seed during storage and transport, and neighboring landowners documented spread beyond field boundaries. Evaluation by an interagency task force began in 2005, and by 2008 reproductive plants were documented at eight locations distant from cultivated plots. Masses of flowering plants were also observed along access roads adjacent to farmed fields, and unwanted plants proved difficult to eliminate.

Bales of harvested plants have remained piled at the airport site since 2005, with additional bales added, but no indication that transport and processing of the crop is occurring. The acreage currently planted with *Alyssum* is not known, although nine planted sites have been located, most with documentation of spread beyond field boundaries. Attempts by The Nature Conservancy to remove existing plants after purchase of a site previously planted with both species have not been successful, and this summer's herbicide treatment of the airport site also resulted in low mortality.

Growth Characteristics

In their native habitat, plants of *Alyssum murale* grow to 0.5 – 0.75 meter in height, with multiple woody stems emerging from a stout caudex (Dudley 1965). However, escaped and cultivated plants of this species in the Illinois Valley are considerably larger, and may reach one meter or more in height (Figure 3). The gray-green oval or spatula-shaped (wide at the top and narrower at the bottom) leaves of *A. murale* are 0.5-1.0 cm long and are covered with tiny stellate hairs. *A. corsicum* is very similar, although the leaves of this species are more oval in shape and have a dense covering of silvery hairs, giving them a pale gray or white appearance. Plants of both species produce hundreds of small, bright yellow flowers on branched umbels (corymbs) in early summer. Because most leaves

are shed prior to the initiation of flowering, the two species look almost identical when in flower. No native plants are similar to either *Alyssum* species once flowering has begun, allowing for fairly reliable identification of cultivated and escaped mature plants in the field. Plants are fast growing perennials, reaching reproductive maturity within one or two years, and appear to be fairly long-lived, as large plants at the airport site have been producing seed for three consecutive years.

Reproduction, Survival and Dispersal

The showy flower clusters of both *Alyssum* species attract numerous insects. Although both species are reported to exhibit “low seed set” and be self-incompatible (McKenna et al. 2002), seed set on escaped plants in the Illinois Valley - even those occurring as single isolated individuals - is high. Both species produce the papery, circular to oval flattened fruits (silicles), each with a single flattened seed, that are typical of the genus. Hundreds of seeds are produced by each plant, and germination in the field is prolific. Seeds shed from baled plants as they were transported from satellite locations within the Illinois Valley to the Airport for processing are also viable, and their ability to germinate and grow under harsh conditions has allowed for the development of several roadside populations (Figure 4).



Figure 3. Plant of *A. murale* pulled from the Seats Dam site in 2007. (Photo by K. Amsberry.)

Seeds also germinate and grow well under controlled conditions. In November 2007, seed collected in summer of 2007 from mature plants near the Illinois Valley Airport was tested for viability at Oregon State University (OSU). Seeds were planted on serpentine soils collected from the Rough and Ready Botanical Area, as well as standard greenhouse potting mix.

In the greenhouse, 60% of the seed planted on native soil emerged within one week - interestingly 85% of seed planted on potting mix also germinated (Figure 5). However, six months later, plants

on serpentine soil were much more vigorous, with some starting to produce flowers. Germination also occurred in unheated flats in the nursery yard, although at lower rates. This study corroborates the results of earlier research demonstrating high survival rates (92% survival) for *A. murale* seedlings planted on nickel rich soils under field conditions



Figure 4. An *A. murale* population found at the base of the Lone Mt./Wimer road in 2008. This population consisted of 198 seedlings and 21 flowering plants - all were removed after documentation. The road is a primary access route onto the Josephine ophiolite shield (one of the largest and most botanically unique masses of serpentine bedrock in North America). (Photo by K. French.)

(Pendergrass and McKenna 2006). Initial crop development research on *A. murale* also documented easy seed germination, vigorous growth of seedlings and mature plants, and high tolerance of drought (Chaney et al. 2003a).

Although the dispersal mechanisms characteristic of *A. murale* in its native habitat are not known, fruits of this species are papery and fairly light, and can be easily blown by wind. In addition, portions of corymb with attached fruits easily break away from the mature plant, and these dry “mini-tumbleweeds” are also readily dispersed by wind.



Figure 5. All four seeds planted in this pot of soil collected from the Illinois Valley emerged vigorously within a few days of planting. The overall emergence for this treatment was 60%; n = 9. Inset shows plant after three weeks. (Photos by M. Carr.)

Seeds that have been released from their papery covering, and those with the covering intact, float on water (Figure 6), indicating that wind/and or water may be responsible for the non-human mediated dispersal observed in the Illinois Valley.



Figure 6. Seeds and fruits floating in water in a Petri dish in the lab. Seeds continued to float for more than 24 hours until the dish was discarded. Many seeds had begun to germinate vigorously (while floating) by that time. (Photo by K. Amsberry.)

Native Distribution

Alyssum murale is a widespread species found on serpentine soils throughout central and southern Europe (Dudley 1965). It is a well-represented component of the serpentine flora in this area, and is frequently documented from “waste areas,” indicating its tolerance of harsh conditions. This species is very variable, exhibiting high levels of genetic variation (Mengoni et al. 2003), as well as subspecific morphological variation recognized by traditional taxonomy (Dudley 1965). *A. corsicum* has a more restricted range, occurring only in Turkey and Corsica, with the Corsican population theorized to have been transported from Turkey by humans (Mengoni et al. 2003).

Breeding agricultural cultivars of these two species has been a priority for development of *Alyssum* species for phytomining (2003b). Inclusion of diverse germplasm from throughout the species range was proposed as a component of the development of *Alyssum* for use in the Illinois Valley and

elsewhere, and several cultivars currently exist. Genetic engineering has been proposed as a component of continuing crop development, and patents for phytomining, including development and use of genetically modified strains of *Alyssum murale*, have been applied for <http://www.freepatentsonline.com/EP0993510.html>). The source and genetics of plants used in the Illinois Valley plantings is not known.

Infestations in North America

Escaped plants

Plants of *Alyssum murale* outside of cultivated fields were first discovered in Oregon in 2006 on U. S. Forest Service land by botanical technicians working for Wild Rivers Ranger District on the Rogue River-Siskiyou National Forest. Following the discovery of two separate infestations, the Wild Rivers District Botanist began formally tracking and removing plants on public land (Table 1). To date, a total of 404 plants have been removed from land administered by the USFS, BLM, State and ODOT (113 flowering plants, 291 non-flowering plants). More escaped *Alyssum* may be going undetected due to a lack of surveys and a lack of knowledge of other *Alyssum* plantings near public land.

Despite a lack of intensive surveys, each year new *Alyssum* infestations have been detected. In 2008, three days of surveys resulted in the discovery of five new sites, and documented increasing plant counts at known sites (Table 1; Figures 7-9). The infestation at Seats Dam is more than one mile from known plantings, and is presumed to have developed from seeds carried on vehicle tires as Viridian employees travelled from the airport fields to go swimming at the dam. One plant occurred in this site in 2006, four plants in 2007 and 156 plants in 2008 (91 seedlings, 65 flowering plants). All plants were manually removed at the time of their discovery, and specific locations of infested areas were documented.

The variety of habitats and locations infested by *Alyssum* is increasing. Currently occupied habitats range from gravel shoulders along Highway 199 (Figure 7), to ditchline and disturbed areas at Seats Dam, a popular local recreation site (Figure 8), to gravelly roadside traversing serpentine (Figure 4) to completely undisturbed native plant community hundreds of feet from any trail or road (Figure 9).

Table 1. Locations of *Alyssum murale* outside of cultivated fields, within the vicinity of the Illinois Valley Airport and Lone Mountain Road plantings.

Location	Ownership	Year discovered	Year monitored		
			2006	2007	2008
Seats Dam	USFS	2006	1	4	156
Hwy 199 RR Bridge S. To MP 35	ODOT	2006	2	2	6
Hwy 199 across from R & R Bot. Wayside	ODOT	2007	na	1	5
BLM <i>L. cookii</i> site	BLM	2008	na	na	5
Lone Mt./Wimer Rd.	USFS	2008	na	na	219
R &R State Wayside	State	2008	na	na	1
BLM Ditchline Rd.	BLM	2008	na	na	1
BLM Powerline Jeep Trail	BLM	2008	na	na	1
Yearly Totals (All Sites)			3	7	394

Although a collection of *A. murale* made in 1963 (from a garden in Benton County) is stored in the OSU Herbarium, this species has not been considered a component of the Oregon flora. However, this weedy mustard is included as “an escape from cultivation” in the Canadian flora (Mulligan 2002), and has been collected several times since 1981 from a “well-established, spreading population” in Colorado (Colorado University Museum 2003). No information regarding the source of the plants, or the nature of the soils (i.e. serpentine) where they were collected is available. Although the unique edaphic conditions characteristic of serpentine plant communities generally protect them from invasion by weeds, vigorous, well-adapted perennials such as *A. murale* and *A. corsicum* have the potential to establish themselves on southern Oregon’s nickel-rich soils as easily as on the serpentine of their native habitats.



Figure 7. Bob Meinke (ODA) approaches one of five flowering *A. murale* plants growing along Highway 199 directly across from the state Rough and Ready Botanical Wayside in 2008. One plant was removed by ODA staff from this same location in 2007. (Photo by M. Jules.)



Figure 8. Maureen Jules (USFS) points at seedlings growing next to flowering *A. murale* near Seats Dam in Rogue River-Siskiyou National Forest. Seats Dam is a popular recreation site for day use, camping and OHV activity for both tourists and local residents. This year 91 seedlings and 65 flowering plants were removed from the site. (Photo by K. French.)



Figure 9. *A. murale* growing within an undisturbed plant community hundreds of feet from a trail or road within the Rough and Ready Area of Critical Environmental Concern. A total of five plants were discovered and removed from this site in 2008. (Photo by K. French.)