Controlling the spread of stinkwort, yellow star thistle, and medusahead around Pinnacles and South County:

Projects, Techniques, Partnerships, Opportunities

Amelia Ryan
Pinnacles National Park

Strategies

- Prevention
- Early treatment/eradication
- Containment
- Management

Prevention

- Look for new or unfamiliar plants
- Be vigilant about what you are bringing in:
  - Aggregate
  - Hay
  - Equipment
  - Stock
- Be careful what you move around
  - Mowing
  - Dirt moving
  - Stock

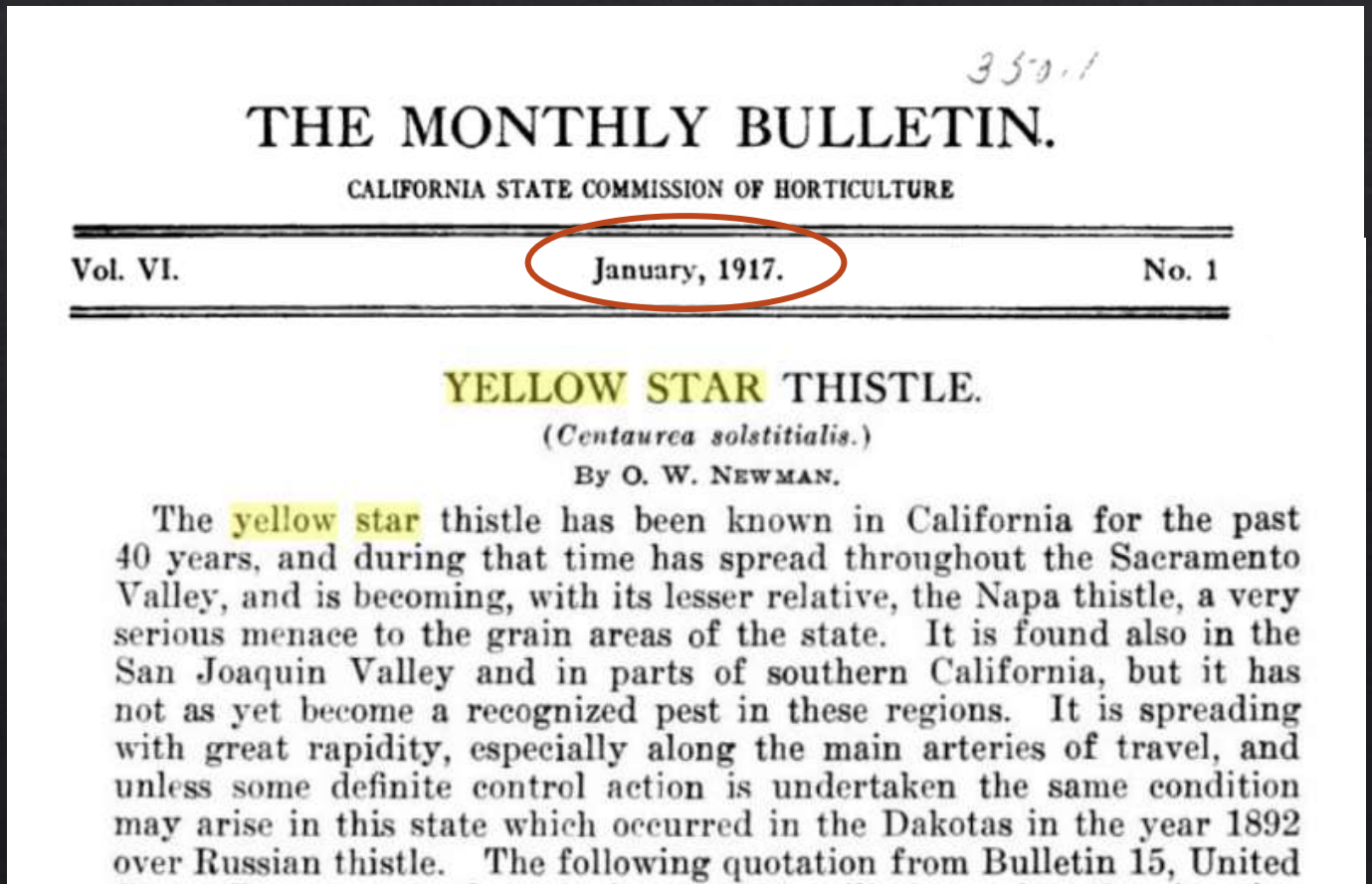
Yellow Star Thistle - Management

Yellow Star Thistle – Management

- Likely introduced to California in 1850 in alfalfa hay from Chile
- Spread around California initially in hay and agriculture

Yellow Star Thistle – Management

- Likely introduced to California in 1850 in alfalfa hay from Chile
- Spread around California initially in hay and agriculture



350.1

THE MONTHLY BULLETIN.

CALIFORNIA STATE COMMISSION OF HORTICULTURE

Vol. VI. January, 1917. No. 1

YELLOW STAR THISTLE.

(*Centaurea solstitialis.*)

By O. W. NEWMAN.

The yellow star thistle has been known in California for the past 40 years, and during that time has spread throughout the Sacramento Valley, and is becoming, with its lesser relative, the Napa thistle, a very serious menace to the grain areas of the state. It is found also in the San Joaquin Valley and in parts of southern California, but it has not as yet become a recognized pest in these regions. It is spreading with great rapidity, especially along the main arteries of travel, and unless some definite control action is undertaken the same condition may arise in this state which occurred in the Dakotas in the year 1892 over Russian thistle. The following quotation from Bulletin 15, United

Yellow Star Thistle – Management

- Likely introduced to California in 1850 in alfalfa hay from Chile
- Spread around California initially in hay and agriculture
- Well established by 1958 (see 1963 weed bulletin)

BARLEY SEED SURVEY

Shows Quality Problems

M. D. MILLER · C. W. SCHALLER · E. C. BRUCH · F. G. PARSONS

Weed seed content

Fifty-four per cent of the samples would not have met certification standards because of excessive weed seed. Twelve per cent of the samples contained secondary noxious weeds including wild morning glory, yellow star thistle and

Farm advisors in the following counties participated in portions of this study: Alameda, Contra Costa, Glenn, Kings, Lake, Lassen, Modoc, Napa, Orange, San Benito, San Bernardino, San Luis Obispo, Shasta, Siskiyou, Tehama, Ventura and Yolo.

Yellow Star Thistle – Management

- Likely introduced to California in 1850 in alfalfa hay from Chile
- Spread around California initially in hay and agriculture
- Well established by 1958 (see 1963 weed bulletin)

BARLEY SEED SURVEY

Shows Quality Problems

M. D. MILLER · C. W. SCHALLER · E. C. BRUCH · F. G. PARSONS

Weed seed content

Fifty-four per cent of the samples would not have met certification standards because of excessive weed seed. Twelve per cent of the samples contained secondary noxious weeds including wild morning glory, yellow star thistle and

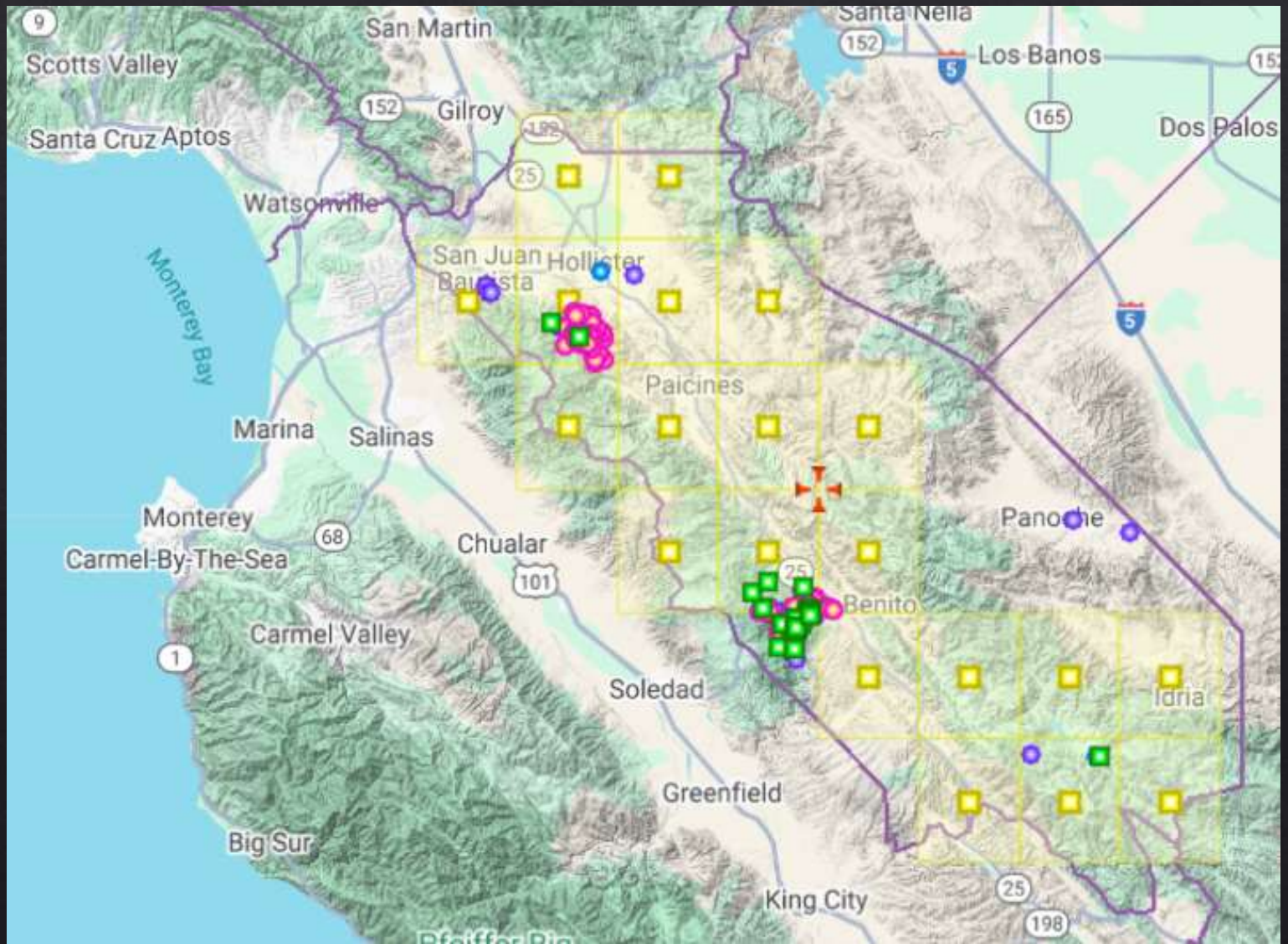
Farm advisors in the following counties participated in portions of this study: Alameda, Contra Costa, Glenn, Kings, Lake, Lassen, Modoc, Napa, Orange, San Benito, San Bernardino, San Luis Obispo, Shasta, Siskiyou, Tehama, Ventura and Yolo.

Yellow Star Thistle – Management

- Likely introduced to California in 1850 in alfalfa hay from Chile
- Spread around California initially in hay and agriculture
- Well established by 1958 (see 1963 weed bulletin)

1963 specimen from Clear Creek

Yellow Star Thistle



Yellow Star Thistle – Management

- Dries out pasture (15-25% loss of annual precip)
- Toxic to horses (nutritious to cattle in some phases)
- Moderate to heavy infestations reduce carrying capacity of rangelands ~20-50%

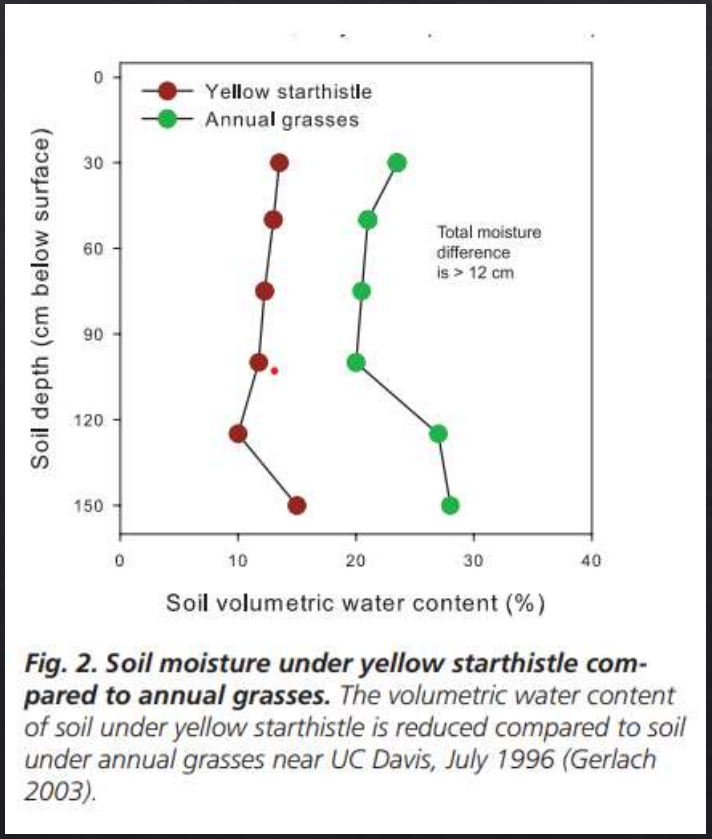


Fig. 2. Soil moisture under yellow starthistle compared to annual grasses. *The volumetric water content of soil under yellow starthistle is reduced compared to soil under annual grasses near UC Davis, July 1996 (Gerlach 2003).*

YELLOW STARTHISTLE

CENTAUREA SOLSTITIALIS

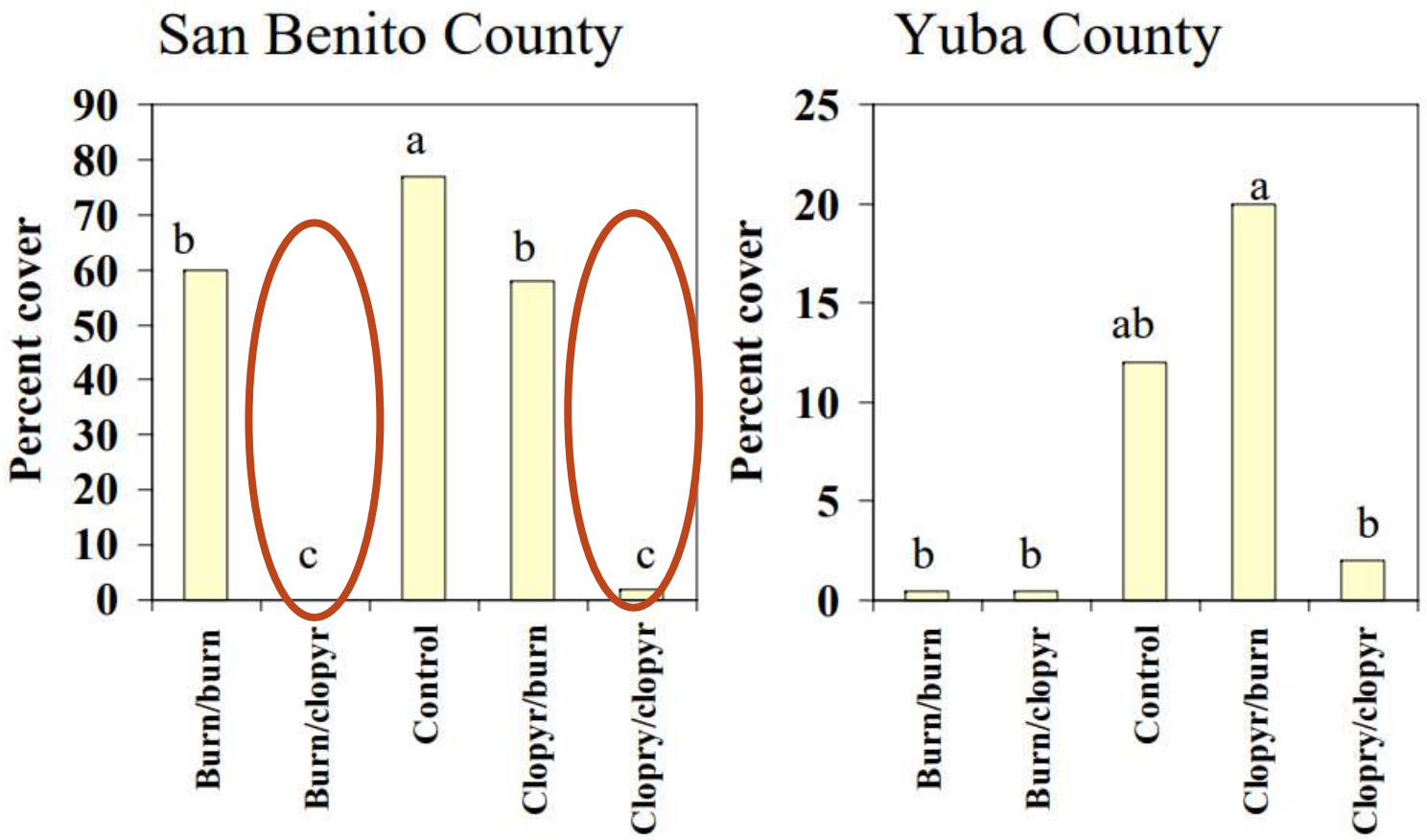
annual herb (sunflower family)

Leaves form basal rosette, deeply divided, triangle-tipped, basal leaves die off after bolting

Stems bolt May/June, blue-ish green with fleshy leaf-like “wings” running length of stem

Flower heads solitary at end of stalks, yellow, with ¾ - 1 ½ inch spines (June-August)

Yellow starthistle cover following two years of control



J. Di Tomaso 1999

YST Treatment

- Thick infestations:
  - Broadcast spray one to two times with Clopyralid or Aminopyralid (aka Transline and Milestone) with follow-up spot treatment with herbicide or hand/mechanical
  - Burn followed by herbicide
- Small infestations:
  - spot treat with herbicide
  - hand remove
  - Timed mowing: needs to be when ~10% flowering, 1-2” from ground

YST Treatment

- Aminopyralid (Milestone) vs. Clopyralid (Transline) considerations:
  - Very similar mode of action (Auxin plant hormone inhibitors)
  - Safe for rangelands but not broken down by animals or in compost and persist in soil
  - Both Kill broadleafs, especially Daisy (thistles, dandelions), Legume (vetch, pea, clover), and Potato family (tomato, nightshade, jimsonweed)
  - Can slow grass growth if applied right at germination
  - Both have pre-emergent qualities and will suppress weeds the next year
  - Aminopyralid binds more to soil, less likely to leach out
  - Aminopyralid is effective at lower concentrations per acre
  - Aminopyralid should not be applied in root zone of desired shrubs or small trees (e.g. young oaks)

2018-2019 WMA Grant

- National Fish and Wildlife Federation Pulling Together Initiative for WMA/BLM partnerships
  - BLM Clear Creek YST Project – 75 acres
  - PINN Bear Valley/Sandy Creek Expanded YST Project – 65 (new) acres
  - Contract spray YST on adjacent ranch lands around PINN – 100 acres
  - Herbicide subsidy for ranchers treating YST (or other weeds) - 140 acres

2018-2019 WMA Grant

- Treatment gains partially lost due to lack of other WMA funding and very wet 2023 and 2024 rain years
- PINN seeks to work with interested neighbors to help regain ground with new 3-year (25-28) WMA funding

Dittrichia graveolens
(Stinkwort)

Stinkwort -Containment

strong-smelling, glandular foliage and abundant yellow flowers

prolific production of wind-dispersed seeds

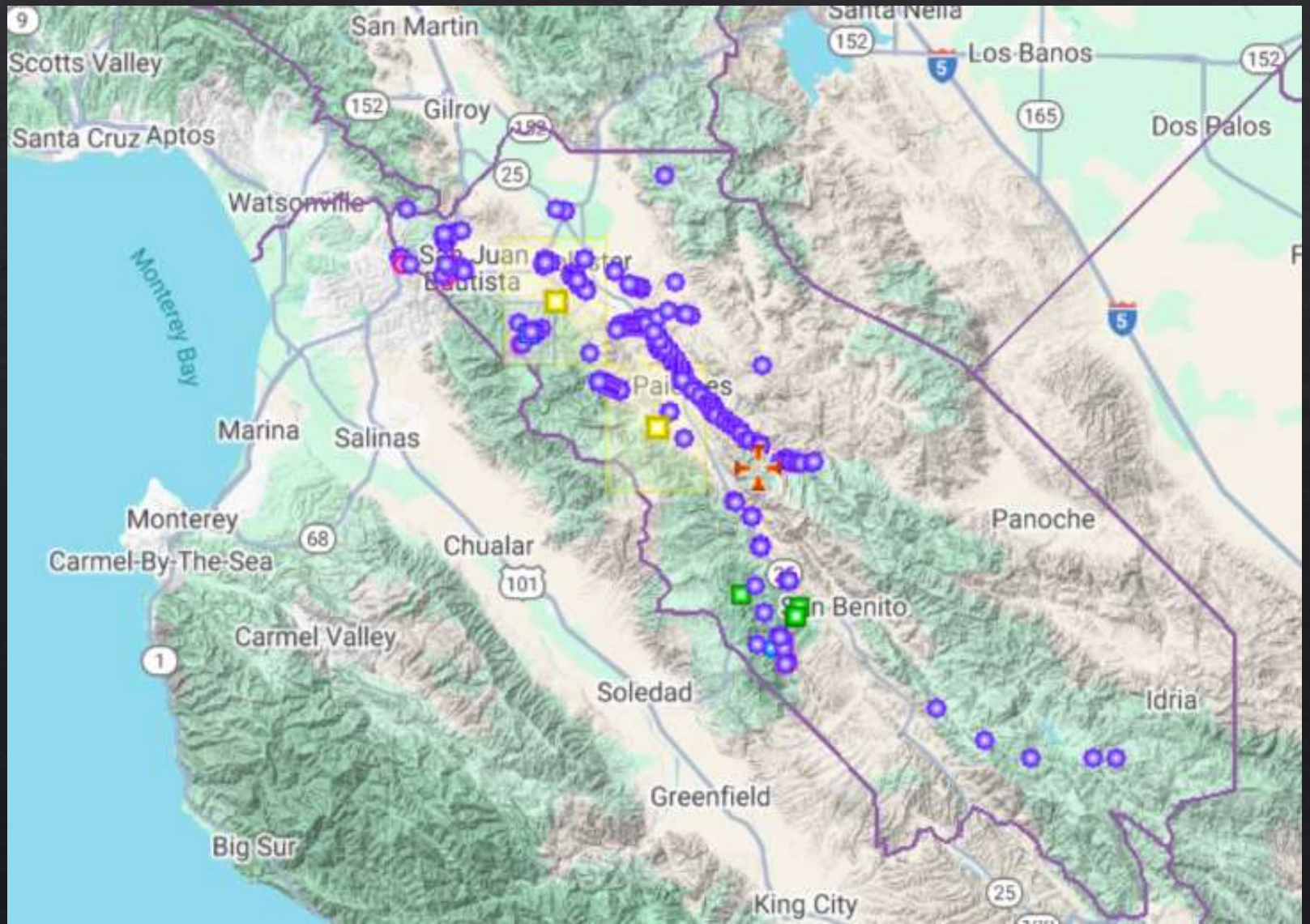
N. Chiariello

What is it? HWY 101 near HWY 25

Stinkwort/Stinkweed
Dittrichia graveolens

- Annual
- Thousands of tiny, viable seeds
- More germination on good rain years
- Currently in disturbed sites, but major rangeland past in other countries
- Not yet well established in south County, but…
  - Moving south of Paicines along Hwy 25, and along San Benito and Tres Pinos Creeks
- Covered in stinky oils, similar to a tarweed
- Flowers tiny, yellow, not showy
- Short "Christmas tree" appearance

Stinkwort


San Martin
Scotts Valley
Santa Cruz
Aptos
Gilroy
Watsonville
Monterey Bay
Marina
Salinas
Monterey
Carmel-By-The-Sea
Carmel Valley
Chualar
Soledad
Greenfield
Big Sur
King City
Los Banos
Dos Palos
Panoche
Idria
152
25
68
101
1
5
165

STINKWORT

DITTRICHIA GRAVEOLENS

annual herb (sunflower family)

Leaves are sticky with and very pungent

Flowers are small and numerous (Sept-Nov)

Dittrichia graveolens
(Stinkwort)

strong-smelling, glandular foliage
and abundant yellow flowers

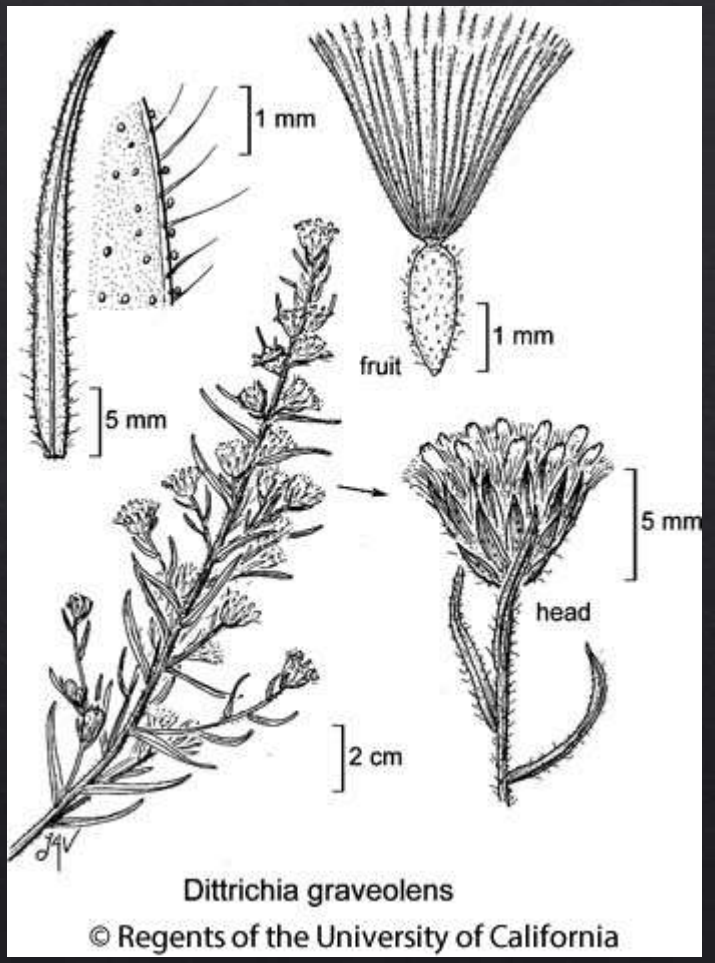
prolific production of
wind-dispersed seeds

N. Chiariello

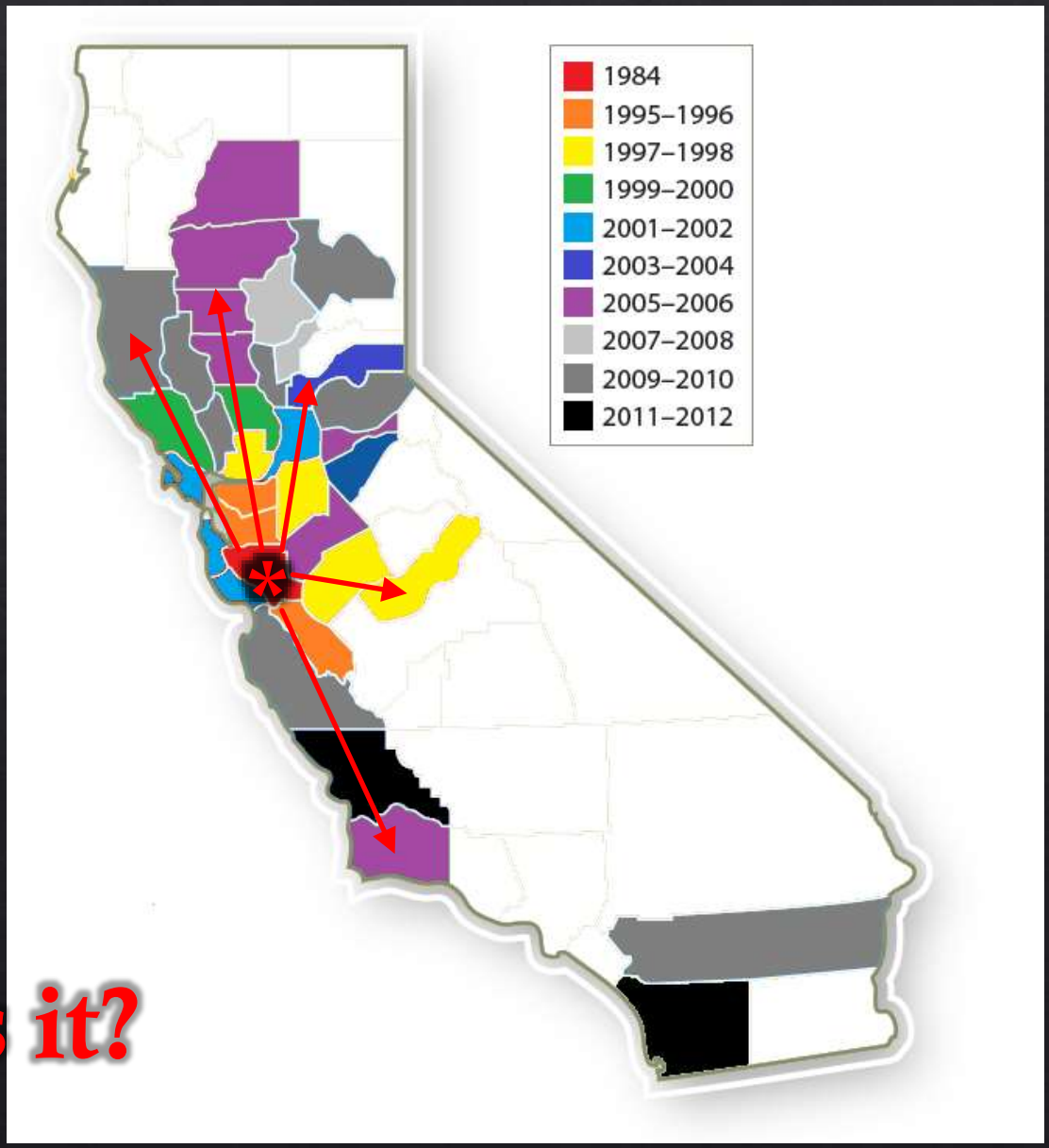
Problems

- Unpalatable or toxic to livestock
- Barbed seed leads enteritis/

  gastrointestinal disease
- Caused 20% mortality in sheep forced to eat it
- Oils taint milk and meat of animals that consume
- Can cause severe dermatitis and allergic reactions



Spread of Stinkwort in California



Introduced in Santa Clara County in 1984

Where is it?

Stinkwort is rapidly expanding its range in California

by Rachel Brownsey, Guy B. Kyser *and* Joseph M. DiTomaso

Stinkwort (Dittrichia graveolens) is a Mediterranean native that has become a weed in areas of Europe as well as in Australia. This strongly aromatic weed was first reported in California in 1984 in Santa Clara County, and it had spread to 36 of the 58 California counties by 2012. Stinkwort is not palatable to animals, and can be poisonous to livestock and cause contact allergic dermatitis in humans. In California, this weed is found primarily along roadsides. However, the biology of this annual plant suggests that it could also invade open riparian areas and overgrazed rangelands. Stinkwort has an unusual life cycle among annual plants: Unlike most summer or late-season winter annuals, stinkwort flowers and produces seeds from September to December. Such basic biological information is critical to developing timely and effective control strategies for this rapidly expanding weed.

Stinkwort is related to fleabanes and goldenasters and grows to about 2.5 feet tall. In California, this rapidly invading weed most often occurs in disturbed and wasteland sites.

Dittrichia graveolens (L.) Grueter, commonly known as stinkwort, is a member of the Asteraceae, or sunflower, family. This plant is native to the Mediterranean region of Europe, occurring as far east as Turkey, Afghanistan and Pakistan (Brullo and de Marco 2000; Qaiser and Abid 2005). Stinkwort is an erect, fall-flowering annual that can grow about 2.5 feet tall. Its foliage has sticky glandular hairs covered in resin. The resin emits a strong aromatic odor that resembles the smell of tarweeds. The flowerheads are 0.2 to 0.3 inch (5 to 7 millimeters) in diameter and consist of short yellow ray flowers on the outer edge and yellow to reddish disk flowers in the center. Stinkwort is closely related to fleabanes, horseweed (*Erigeron*; formerly *Conyza*), goldenasters and telegraphweed (*Heterotheca*), but it also closely resembles the tarweeds (*Centromadia* spp., *Hemizonia* spp. and *Holocarpha* spp.). From a distance, stinkwort can resemble Russian-thistle (*Salsola tragus* L.), also called tumbleweed. Because it is fairly unattractive and nondescript in appearance, stinkwort initially passed unnoticed by many botanists and weed managers, and it was not included in the 1993 edition of *The Jepson Manual* of California flora (Hickman 1993).

In its native range and some introduced regions, stinkwort inhabits riparian woodlands, margins of tidal marshes, vernal pools and alluvial floodplains, although it has not yet invaded these wildland areas in California. In California and other introduced areas of the world, stinkwort is most often found in disturbed places, such as overgrazed rangelands, roadsides, pastures, wastelands, vineyard edges, gravel mines, levees, washes and mining sites, although in California it is seldom found in rangelands or pastures (DiTomaso and Healy 2007; Higueras et al. 2003). Stinkwort grows best on well-drained, sandy or gravelly soils and thrives in areas with hot, dry summers but can also do well along the margins of wetlands. In addition, this plant tolerates a variety of soil types and survives under a range of soil conditions, temperatures and precipitation regimes (Preston 1997). When adequate moisture is available, stinkwort can even survive on serpentine or saline soils. In Europe, this plant was shown to tolerate and to possibly hyperaccumulate heavy metals, including mercury, zinc and copper (Higueras et al. 2003; Shallari et al. 1998).

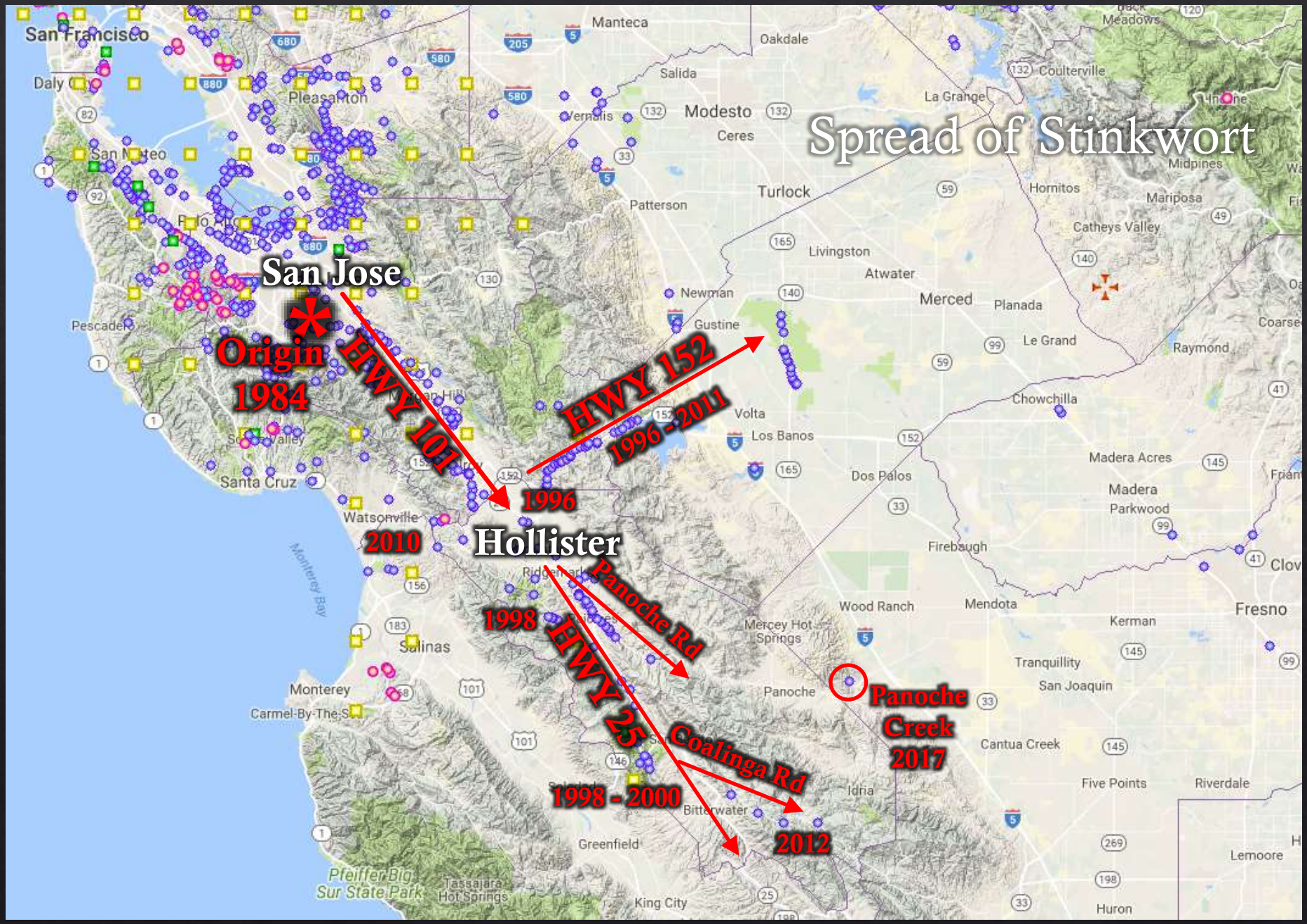
Worldwide invasion

While stinkwort is native to the Mediterranean region, including Egypt and other areas of North Africa, this species has also been introduced to several European countries where it is not native. Within the last two decades, this weed has been spreading rapidly along the highways of Central Europe. In summer 2008, stinkwort was detected for the first time in Slovenia and Austria (Frajman and Kaligaric 2009). Outside of

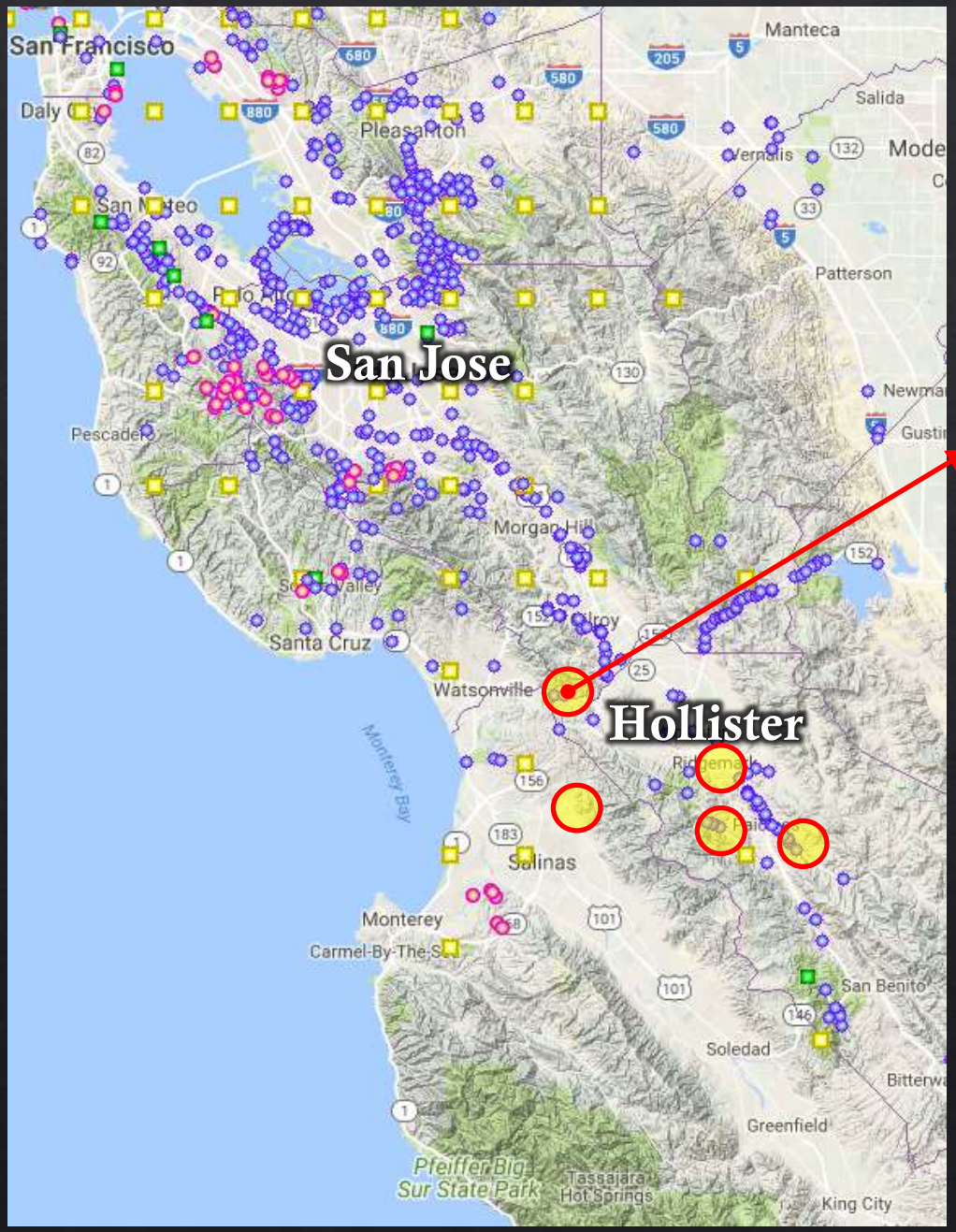
Online: http://californiaagriculture.ucanr.edu/landingpage.cfm?article=ca.v067n02p110&fulltext=yes
doi: 10.3733/ca.v067n02p110

land areas in California. In California and other introduced areas of the world, stinkwort is most often found in disturbed places, such as overgrazed rangelands, roadsides, pastures, wastelands, vineyard edges, gravel mines, levees, washes and mining sites, although in California it is seldom found in rangelands or pastures

California Agriculture 67(2):110-115
April 2013


Spread of Stinkwort
San Jose
Origin
1984
HWY 101
1996
HWY 152
1996 - 2011
2010
Hollister
1998
HWY 25
Panoche Rd
Panoche
Creek
2017
Coalinga Rd
1998 - 2000
2012
San Francisco
Manteca
Oakdale
Modesto
Ceres
Turlock
Patterson
Livingston
Atwater
Merced
Newman
Gustine
Volta
Los Banos
Dos Palos
Chowchilla
Madera Acres
Madera
Parkwood
Firebaugh
Mendota
Fresno
Kerman
Wood Ranch
Mercey Hot Springs
Tranquillity
San Joaquin
Cantua Creek
Five Points
Riverdale
Lemoore
Huron
Idria
Panoche
Coulterville
La Grange
Hornitos
Mariposa
Midpines
Catheys Valley
Planada
Le Grand
Raymond
Pleasanton
Vernalis
Salida
Pescadero
Santa Cruz
Watsonville
Monterey
Carmel-By-The-Sea
Salinas
Greenfield
King City
Bitterwater
Pfeiffer Big Sur State Park
Tassajara Hot Springs
Monterey Bay

Beware of aggregate quarries



Stinkwort

- Spreads mainly through gravel and along roads
  - Often comes in in road projects
  - Spreads through creeks and in quarries
  - Studies suggest it actually prefers nutrient rich soils and access to water (range soils) but it is not a good root competitor, especially with grasses (M. Melen, Parker Lab, UCSC)
  - GRAVELLY CREEKS, roadsides and driveways can act as establishment pathways where it will wait for disturbance such as fire, bad grass germination to move into rangelands
    - Seen in other areas if CA moving into rangelands after disturbance

What can I do to stop it?

Prevention

- Request rock be crushed on demand
- Get rock mined from the middle, not top of quarries
- Washed rock is also less weedy
- Some quarries can heat treat aggregate to kill some weeds for an **extra fee**
- Buried aggregate less of a concern (septic projects, etc)
  - …But remember to consider where it is staged

What can I do to stop it?

Prevention

What can I do to stop it?

Treatment

- Garlon 3A (Triclopyr amine) and Round-up (glyphosate)
- 2,4-D (25oz/acre) somewhat effective
- Small infestations can be hand pulled
- Repeated mowing can reduce, help prevent spread…but major problem if done too late and mower not cleaned

What can I do to stop it?

Effective treatments to control Stinkwort

TABLE 1. Effect of postemergence herbicides and mowing on the control of *Dittrichia graveolens*

Treatment	Product trade name	Ounce product/acre	Ounce acid equivalent (a.e.)/acre	Late postemergence treatment* June 24, 2009	
				% cover	Vigor†
Glyphosate	Roundup Pro	16	6	7.3abcd‡	6.8cd
Glyphosate	Roundup Pro	32	12	5.0ab	4.5b
Aminopyralid	Milestone	3.5	0.875	16.3de	9.8d
Aminopyralid	Milestone	7	1.75	15.0cde	9.0d
Aminocyclopyrachlor	—	4	2	10.0bcd	6.5bc
Aminocyclopyrachlor	—	8	4	7.3abcd	6.5bc
Triclopyr amine	Garlon 3A	32	12	3.0ab	8.5cd
Triclopyr amine	Garlon 3A	64	24	0a	0a
Mowing	—	—	—	5.3abc	10.0d
Untreated	—	—	—	23.8e	10.0d

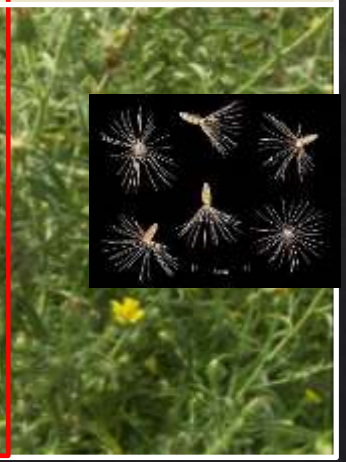
* All late postemergence treatments were made prior to flowering.

† Vigor ratings based on a 0 to 10 scale with 0 = dead plants and 10 = healthy plants.

‡ Numbers in the same column with different letters are significantly different at 5% confidence level.

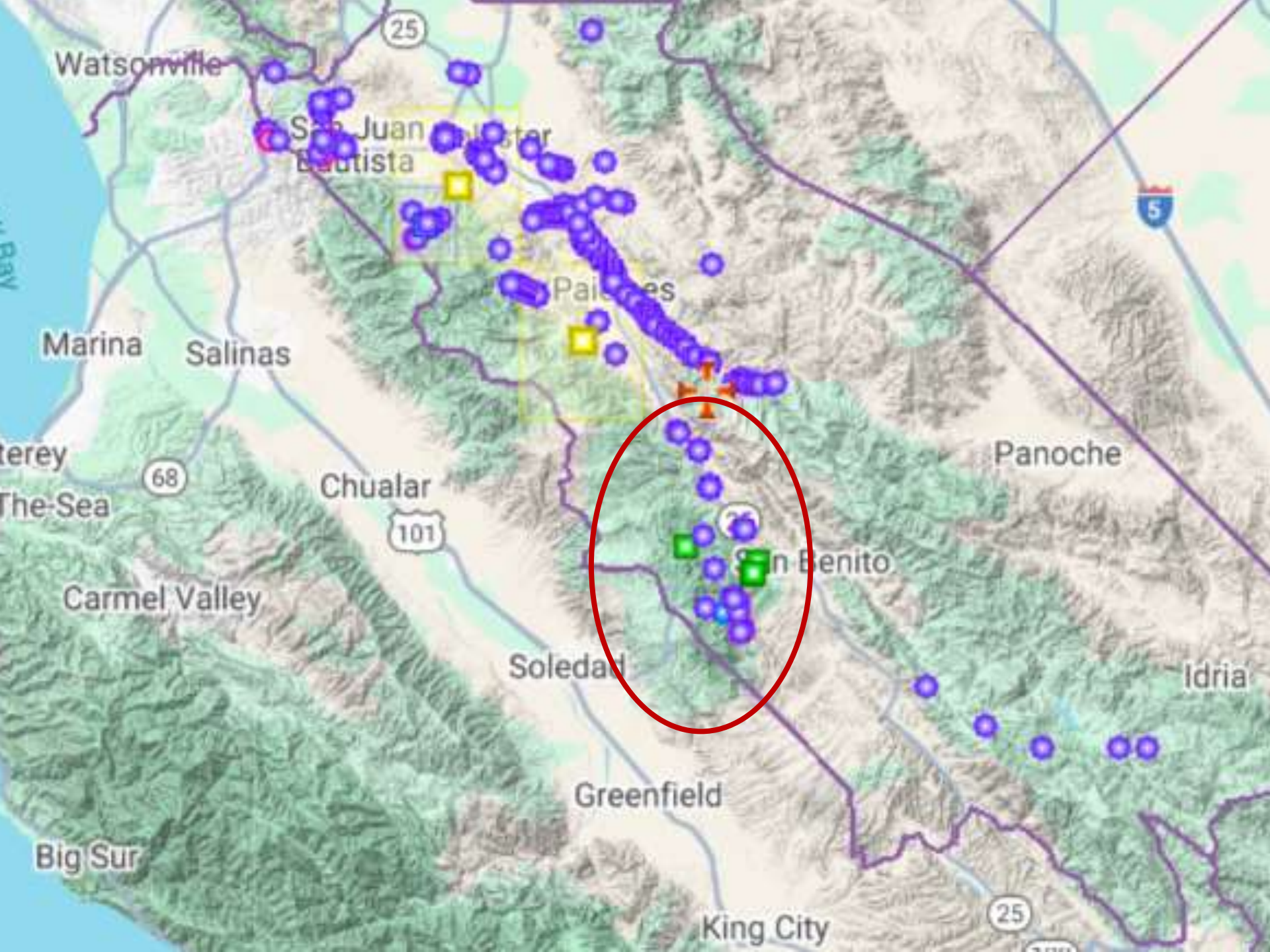
Effective treatment timing to control Stinkwort

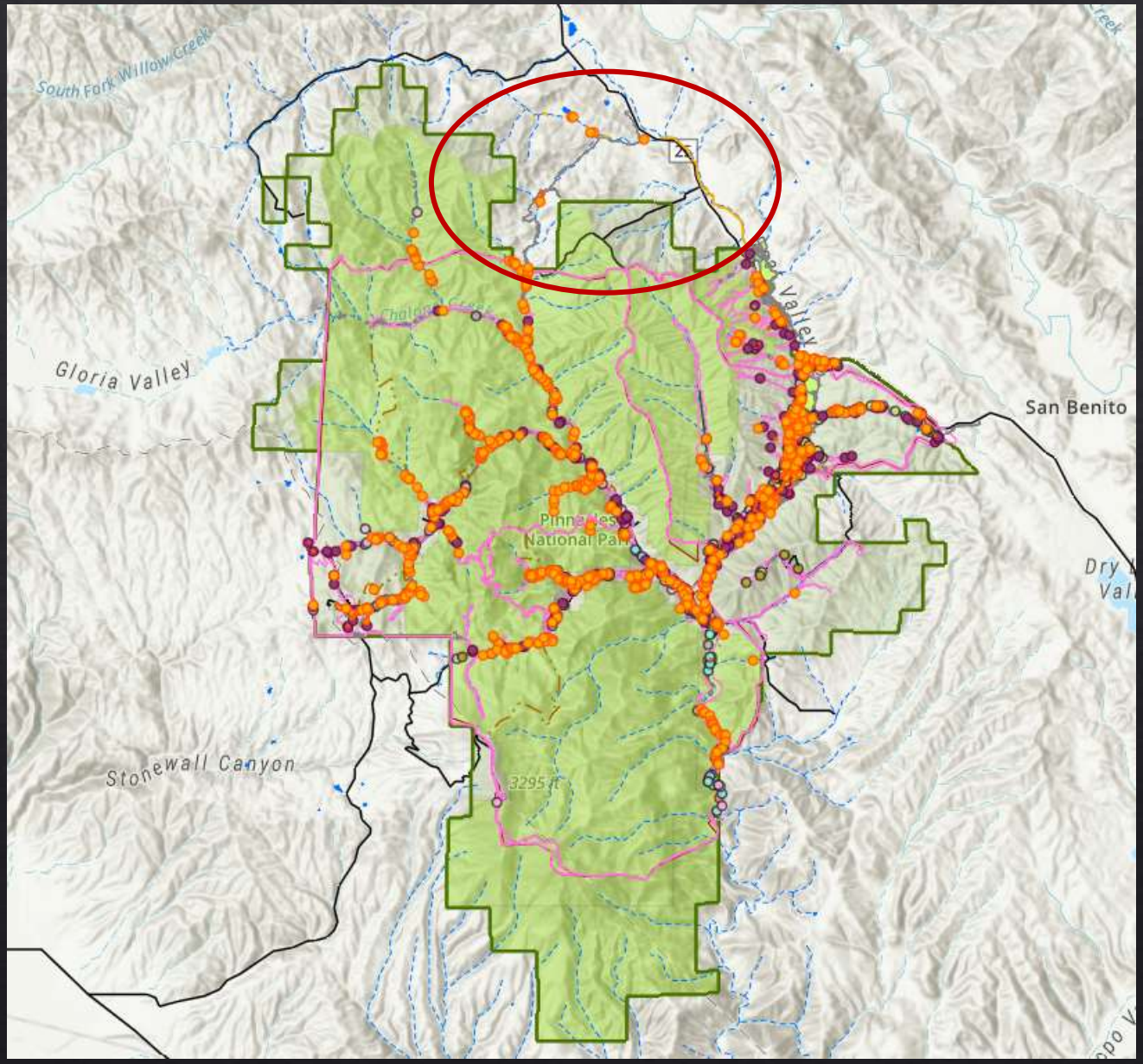
A. Stinkwort	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Germination	Germination										Germination	
Growth				Rosette		Moderate growth		Exponential canopy growth		Too late– seed has dispersed		
Reproduction	Generally too early to see or identify					Optimal treatment interval				Flowering		
										Seed production		
Dispersal										Dispersal		



Stinkwort at Pinnacles

- Small infestation in Chalone Creek came in with gravel in 1998 flood repair,
  - hand pulled every year
  - persisted for 20 years, but at very low numbers
- New infestation discovered in 2020 coming from remote canyon downstream from stockpond on Schmidt-Spencer ranch
  - Partner with Schmidts to treat on their land, park staff hand pulling in difficult to access sites
- 2023 Floods bring in new populations from upstream, discover infestations throughout Bear/Sandy Creek
  - 2023 begin treatment in PINN sections
  - 2024 continue treatment and map and pull in some upstream sections
  - 2025 begin working with Schmidt Family and 4 other neighbors to hand pull all individuals ing Bear/Sandy watershed


Watsonville
25
Marina
Salinas
68
Chualar
101
Carmel Valley
Soledad
Greenfield
Big Sur
King City
25
Panoche
Idria
5

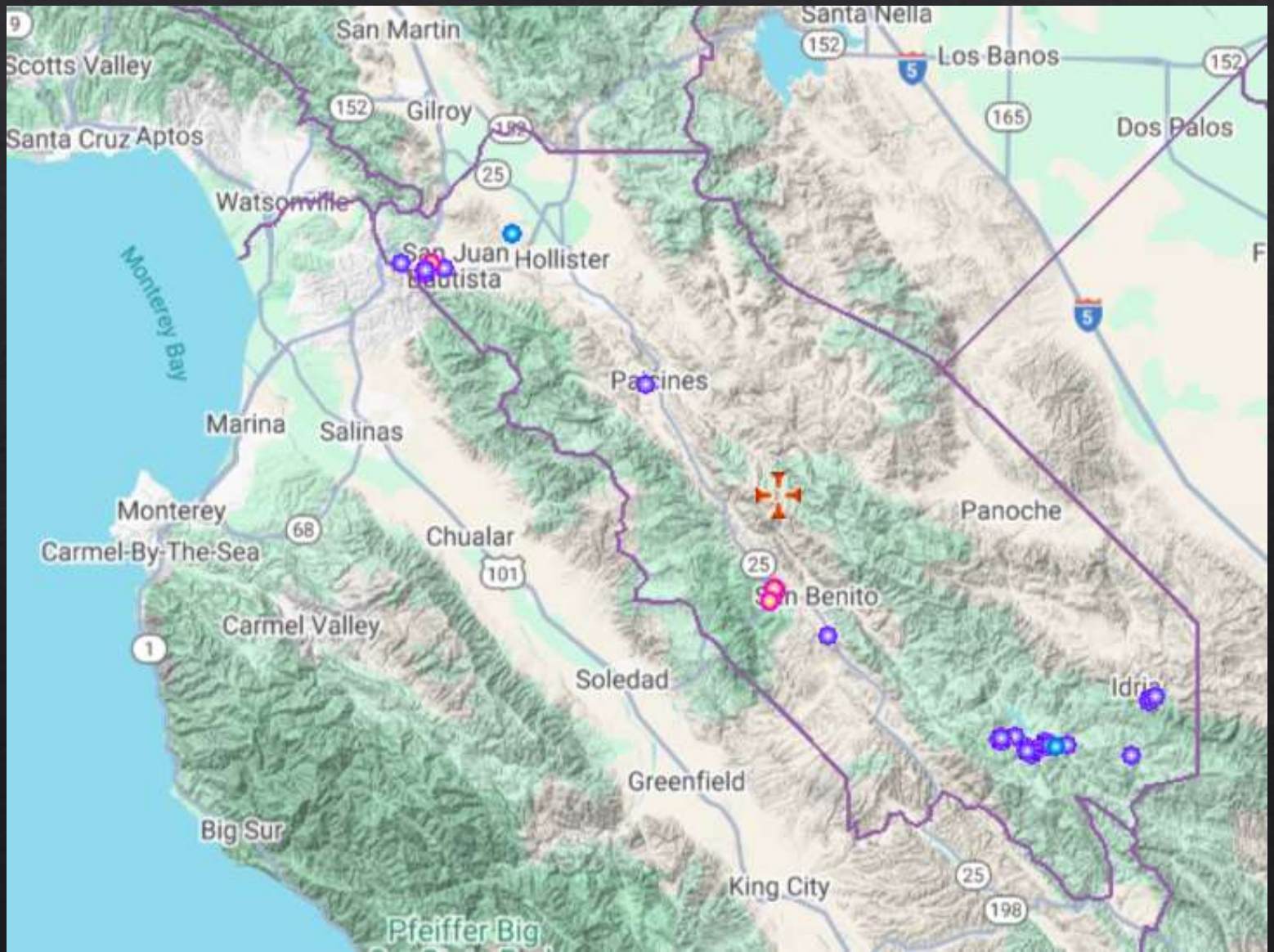

South Fork Willow Creek
Gloria Valley
San Benito
Stonewall Canyon
3295 ft

Medusahead -Containment

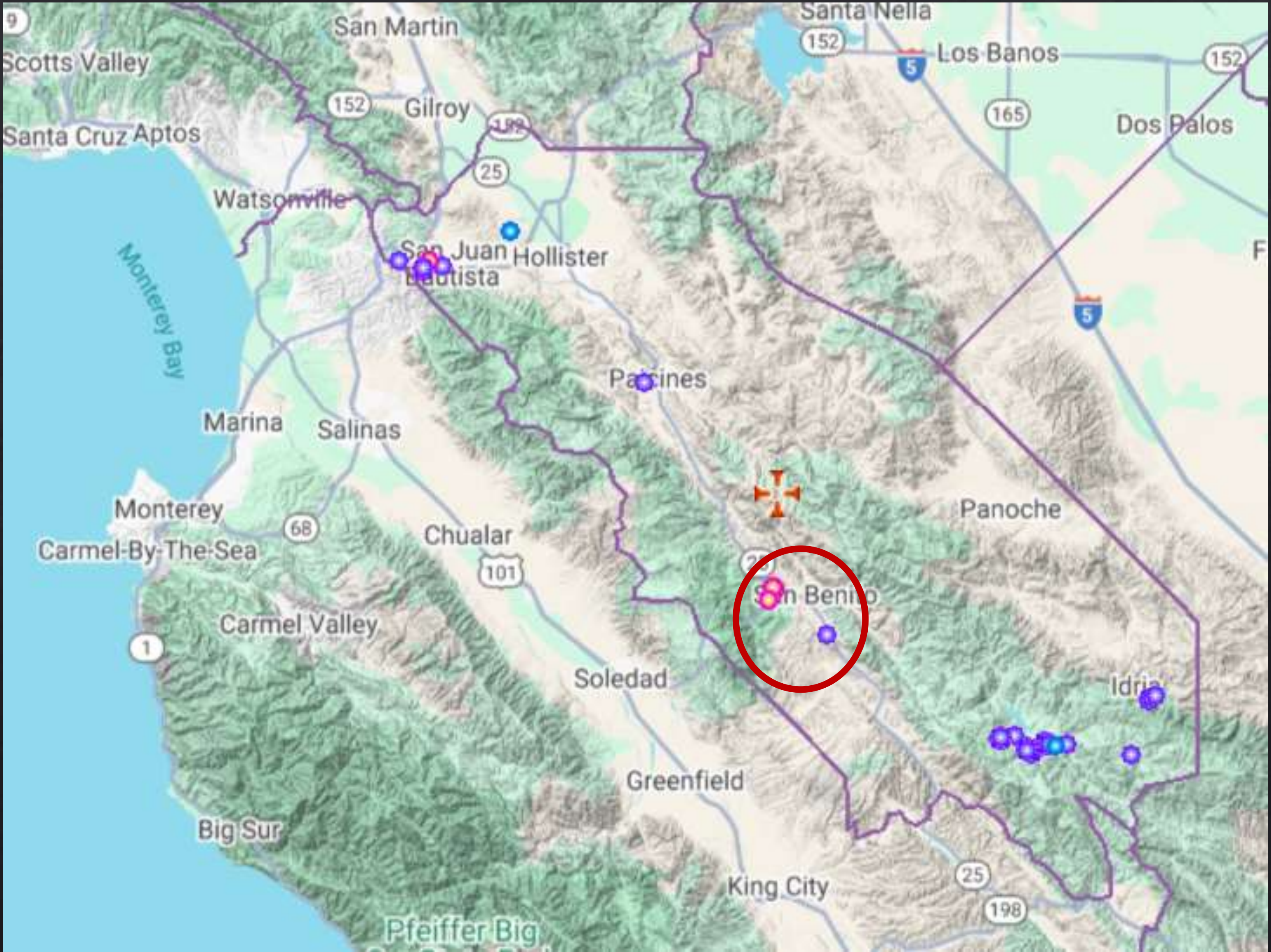
Medusahead

- Winter annual grass introduced from Europe in
- Extremely long (1-3 inch) awns, twist as they dry
- Invades disturbed sites, grasslands, openings in chaparral and oak woodlands.
- Out-competes native grasses and broadleafs
- Flowers and stays greener later than (2-4weeks) than other Annual grasses
- Makes thick patches, lighter tan than other dead annual grasses
- Very poor forage except very early. Significantly reduces range carrying capacity at 10% infestation
- Seeds retained longer on plants. Seeds don't need to touch soil to germinate
- Found throughout northwestern California. Spreading south
  - First collected N. of Hollister in 1957, but not established south until recently

Medusahead


San Martin
Scotts Valley
Santa Nella
Los Banos
Gilroy
Santa Cruz
Aptos
Dos Palos
Watsonville
Hollister
Monterey Bay
Marina
Salinas
Monterey
Carmel-By-The-Sea
Chualar
Panoche
Carmel Valley
Soledad
Greenfield
Big Sur
King City
Pfeiffer Big

Medusahead



San Martin
Santa Nella
Los Banos
Scotts Valley
Gilroy
Santa Cruz
Aptos
Dos Palos
Watsonville
San Juan Bautista
Hollister
Monterey Bay
Paicines
Marina
Salinas
Monterey
Panoche
Carmel-By-The-Sea
Chualar
San Benito
Carmel Valley
Soledad
Idria
Greenfield
Big Sur
King City
Pfeiffer Big

MEDUSAHEAD

Taeniatherum caput-medusae
annual grass

MEDUSAHEAD

Taeniatherum caput-medusae

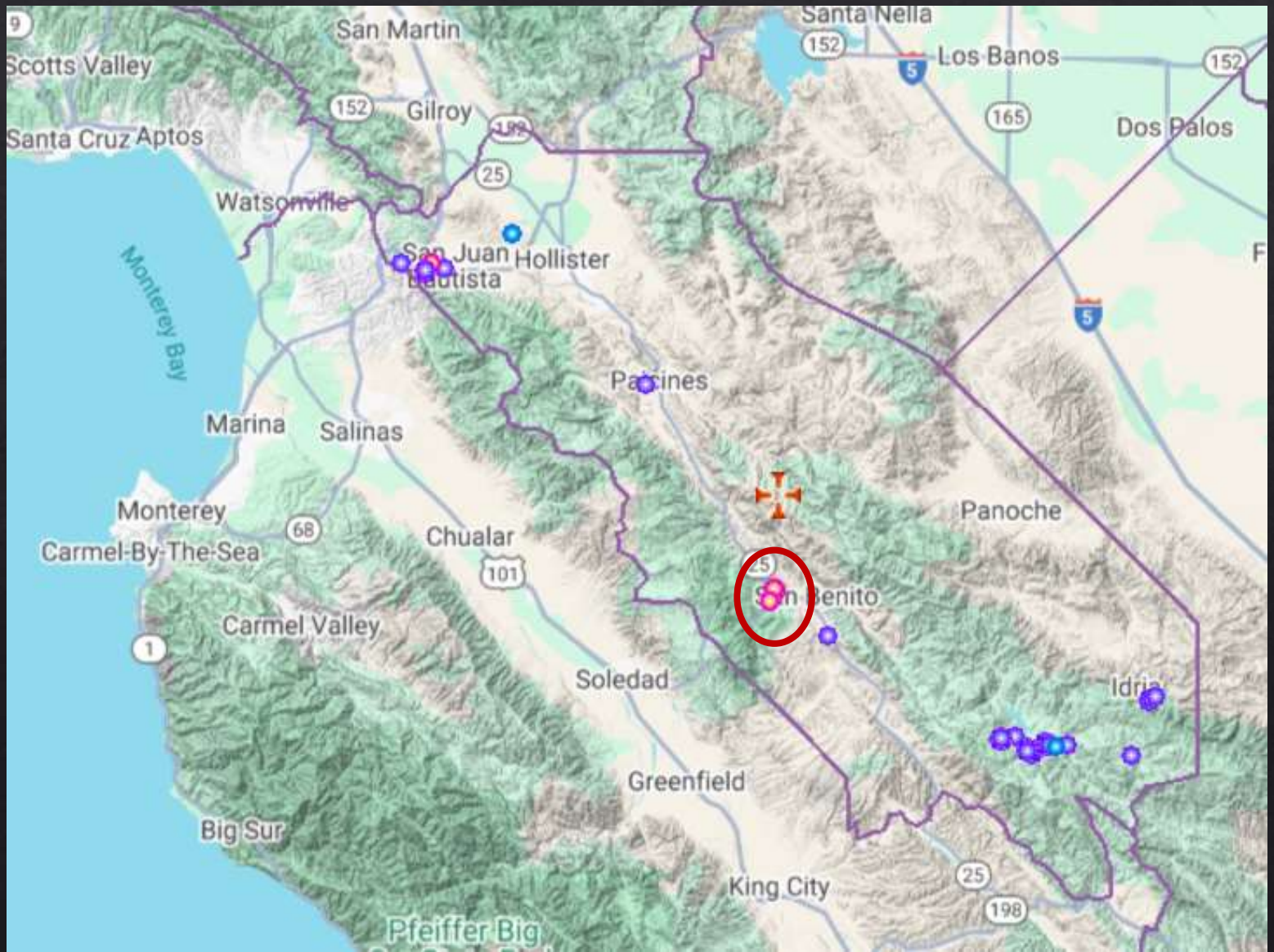
annual grass


lighter tan than other dead grasses

Treatment

- Small patches can be hand treated
- Responds to burns if timing right
- Can respond to timed grazing, especially by sheep, but timing must be right
- Glyphosate or grass specific herbicides can be used, but expensive flor large infestations
- New research suggests medusahead can be treated with Aminopyralid (Milestone) just before heading out ("boot stage").
  - Timing also good for YST, opportunity to co-treat with broadcast (or spot) spray

Medusahead


San Martin
Scotts Valley
Santa Nella
Los Banos
Gilroy
Santa Cruz
Aptos
Dos Palos
Watsonville
Hollister
San Juan Bautista
Monterey Bay
Marina
Salinas
Monterey
Carmel-By-The-Sea
Chualar
Panoche
Carmel Valley
Soledad
Greenfield
Big Sur
King City
Pfeiffer Big

Medusahead at Pinnacles

- Believed spread along Hwy 25 by mowing equipment
- Working with two neighbors to treat small infestations on their land to prevent further spread
- Some larger new infestations visible along Hwy 25 South of the Park

Working outside the park

- Joint Projects part of NPS Public Mandate and covered under Weed Management Area MOU
- Make sure have correct permits from the county
- Hand crews
- Work with private land owners:
  - Consult with land owners on plan
  - Get approval for how plan to treat and how plan to access
  - Confirm day before or day of access

New WMA Opportunities

- 2025-2028 State Weed Management Grant
  - Herbicide Reimbursement or purchase potential for Ranchers with County Permits treating
    - State Listed A, B or Q rated weeds
    - Cal. Code Regs. Tit. 3, § 4500 - Noxious Weed Species
  - Some options for larger projects with County Staff, NPS (Pinnacles) Staff, or Contractors

New WMA Opportunities

- 2025-2028 State Weed Management Grant
  - Herbicide Reimbursement or purchase potential for Ranchers with County Permits treating
    - State Listed A, B or Q rated weeds
    - Cal. Code Regs. Tit. 3, § 4500 - Noxious Weed Species
  - Some options for larger projects with County Staff, NPS (Pinnacles) Staff, or Contractors

Thank you!