Biology, Spread, and Control of Stinkwort in San Benito County

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The first half of the presentation will include the general ecology of stinkwort, the history of its introduction into California, its pattern of spread over time, and current distribution.

The second will apply integrated pest management concepts to treatment considerations for Stinkwort including control options, herbicide selection, and timing.

Appearance

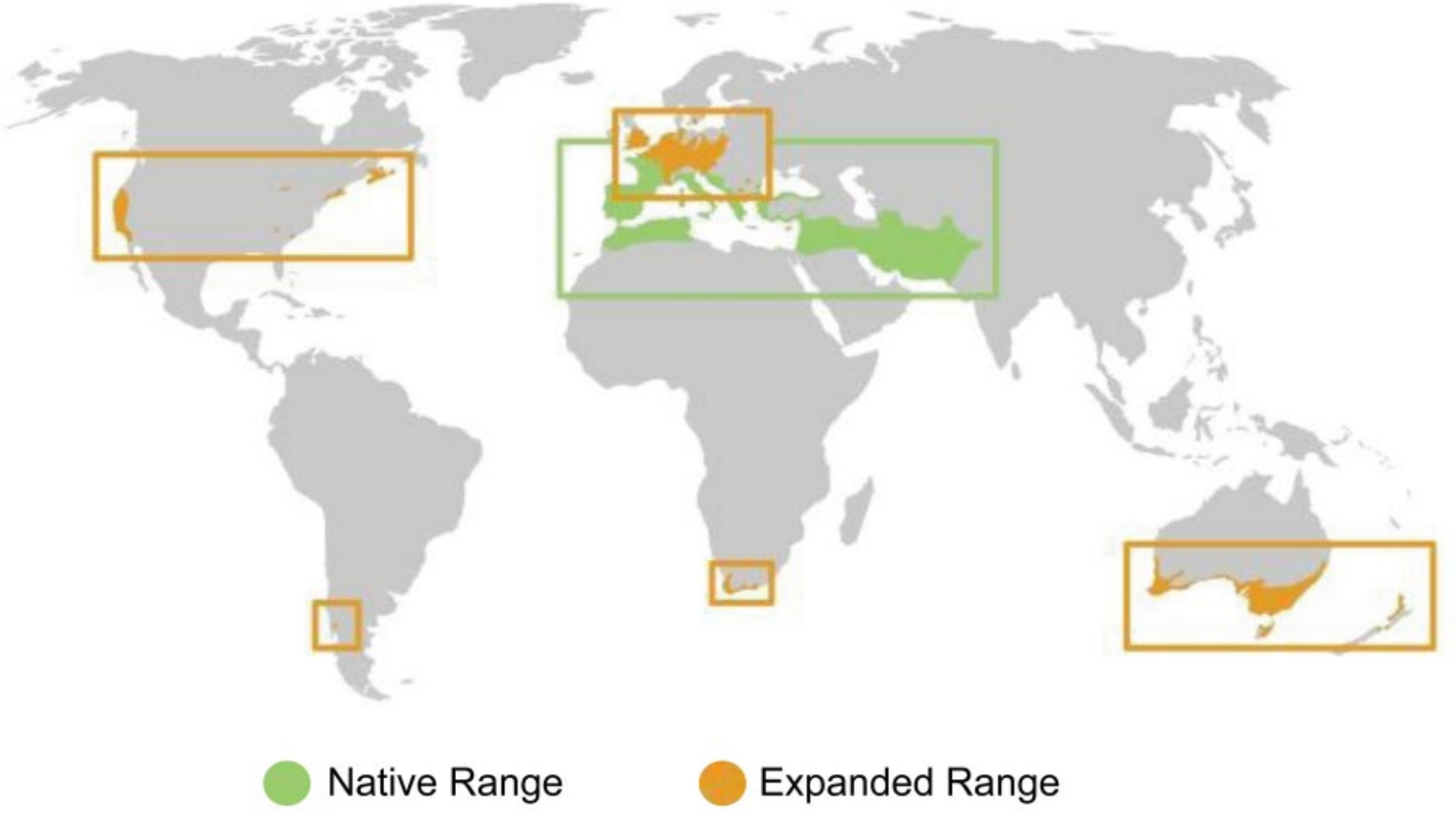
Juvenile plant

Flower

Seeds

Distribution

- Mediterranean climates – Winter cool, wet. Summer hot, dry



Biology

- Sunflower plant family - Asteraceae
- Annual plant
- Life cycle and ecology remarkably similar to CA native tarweed species
- Dispersal as seeds and dormant as seeds in the soil seed bank
- Seed longevity ~ 7 years

Stinkwort
Dittrichia graveolens

Threeray tarweed
Deinandra lobbii

Narrow tarplant
Holocarpha virgata

Life cycle

A. Stinkwort	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Germination	Germination										Germination	
Growth				Rosette		Moderate growth		Exponential canopy growth				
Reproduction									Flowering			
										Seed production		
Dispersal										Dispersal		

Stinkwort is rapidly expanding its range in California

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

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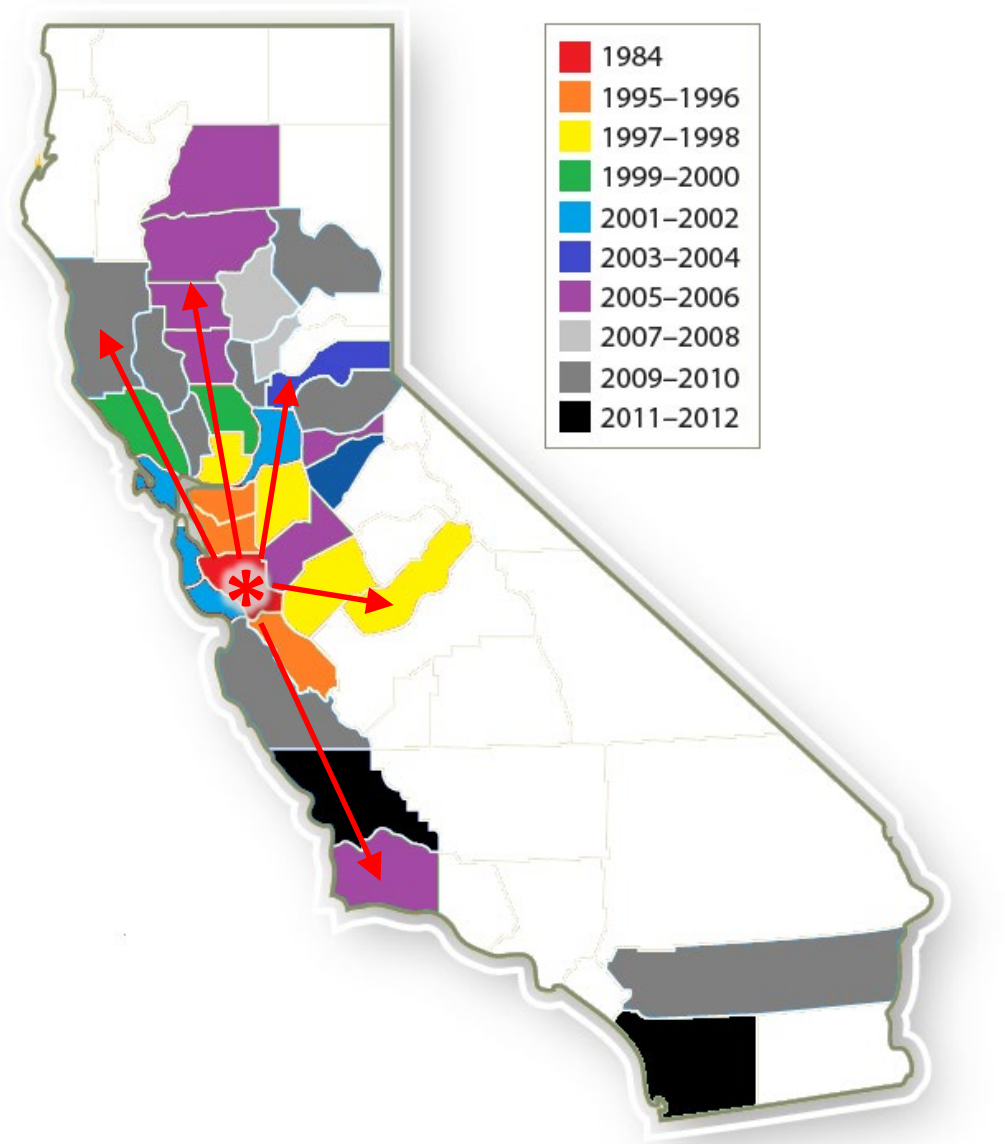
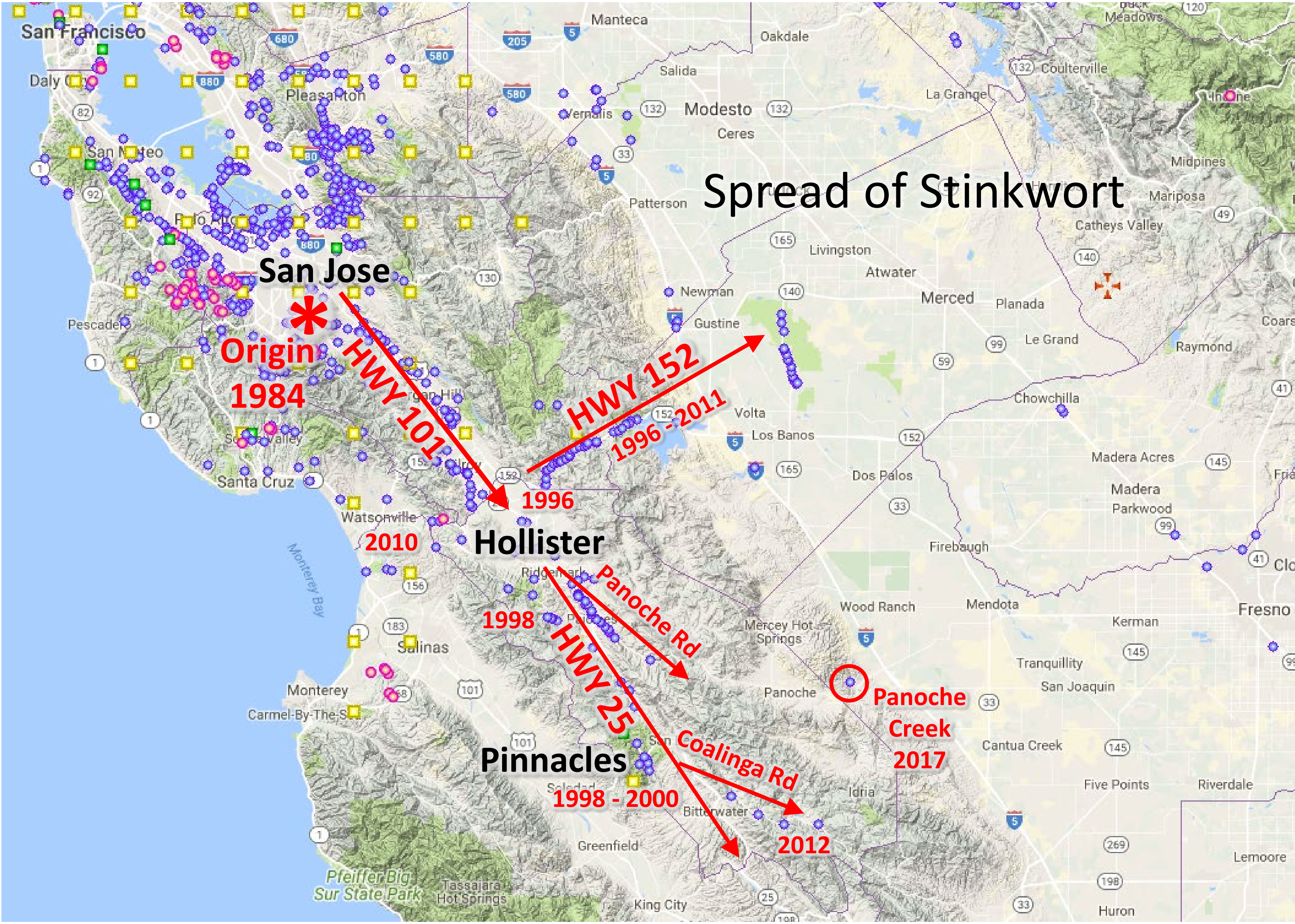
land areas in California. In California and other introduced areas of the world, stinkwort is most often found in disturbed places, such as overgrazed rangelands, roadsides, pastures, wastelands, vineyard edges, gravel mines, levees, washes and mining sites, although in California it is seldom found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

HWY 101 near HWY 25

Spread of Stinkwort in California

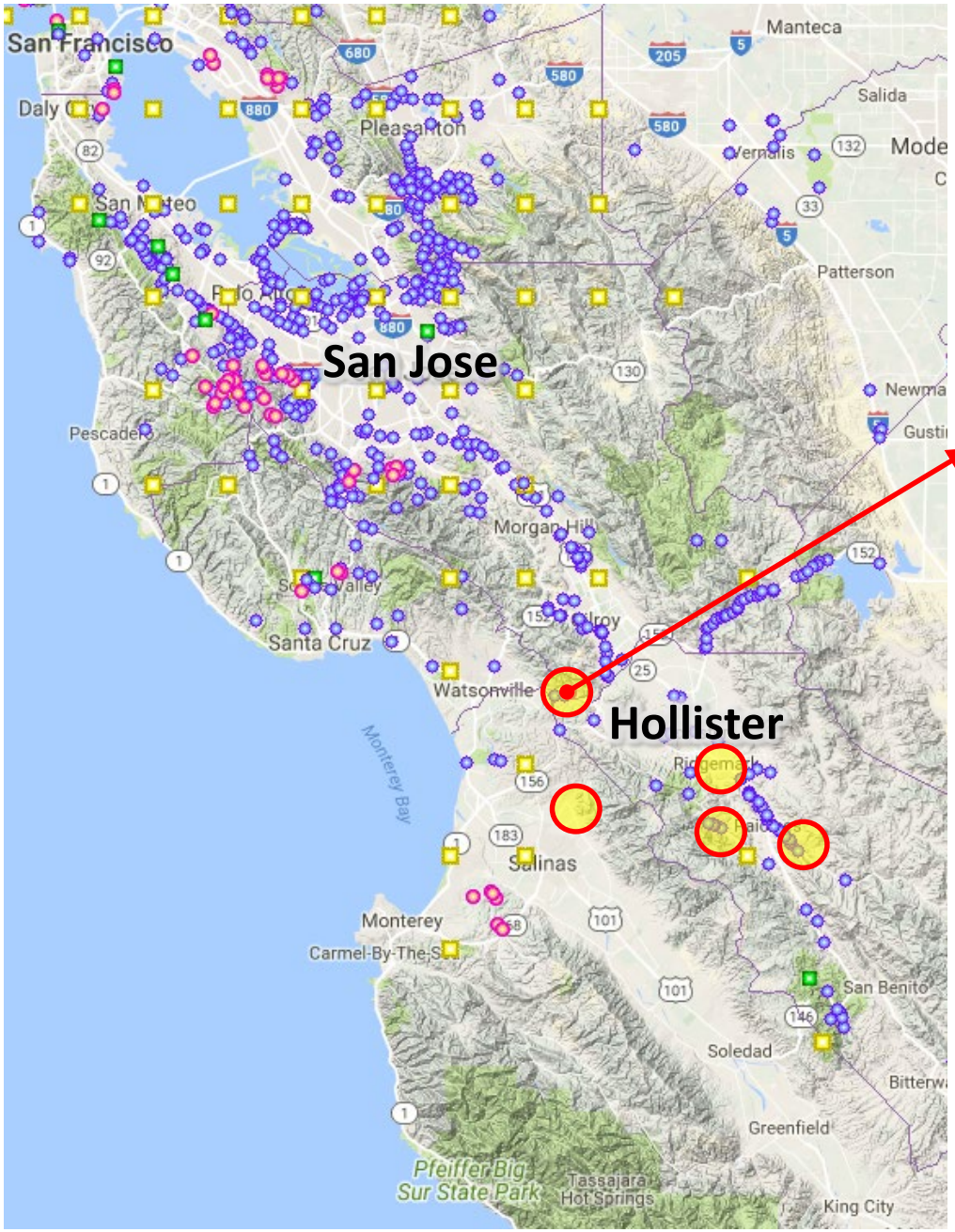



Spread of Stinkwort
San Jose
Origin
1984
HWY 101
HWY 152
1996 - 2011
1996
Hollister
2010
1998
Panoche Rd
HWY 25
Panoche
Creek
2017
Coalinga Rd
Pinnacles
1998 - 2000
2012

How does it spread?

- Plumed seeds carried by the wind or on water
- Seeds in soil seedbank along road – soil moved by road grading
- Seeds in gravel quarry (seedbank) – moved from quarry to construction site
- Seeds stuck to equipment - mowers

Beware of aggregate quarries



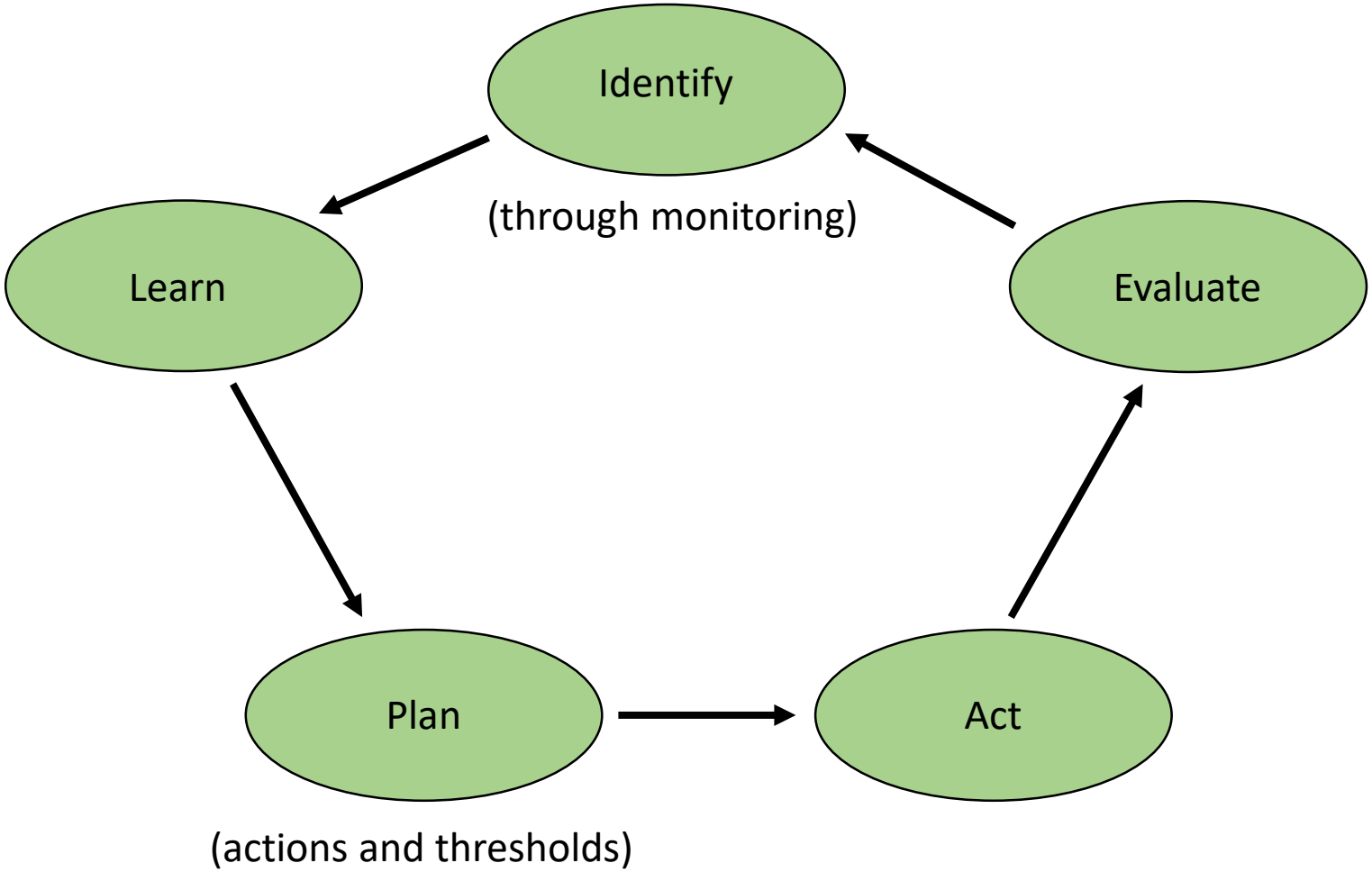
IPM Process

California

1. Pest identification
2. Monitoring and assessing pest numbers and damage
3. Guidelines for when management action is needed
4. Preventing pest problems
5. Using a combination of biological, cultural, physical/mechanical and chemical management tools
6. After action is taken, assessing the effect of pest management

National Park Service

1. Describe your site management objectives and establish short and long term priorities.
2. Build consensus with stakeholders-occupants, decision makers and technical experts (ongoing).
3. Document decisions and maintain records.
4. Know your resource (site description and ecology).
5. Know your pest. Identify potential pest species, understand their biology, and conditions conducive to support the pest(s) (air, water, food, shelter, temperature, and light).
6. Monitor pests, pathways, and human and environmental factors, including population levels and phenological data.
7. Establish "action thresholds," the point at which no additional damage or pest presence can be tolerated.
8. Review available tools and best management practices. Develop a management strategy specific to your site and the identified pest(s). Tools can include: 1) no action, 2) physical, 3) mechanical, 4) cultural, 5) biological, and 6) chemical management strategies.
9. Define responsibilities and implement the lowest risk, most effective pest management strategy, in accordance with applicable laws, regulations, and policies.
10. Evaluate results; determine if objectives have been achieved; modify strategy if necessary (adaptive management).
11. Education and outreach. Continue the learning cycle, return to Step 1.


Identify
(through monitoring)
Learn
Evaluate
Plan
Act
(actions and thresholds)

Relevant Biology

- Small seeds that are easily spread
- High germination rate
- Long and variable germination period
- Damage prompts flowering
- Matures Late in the season
- Sticky hairs covered in aromatic resin
- Seeds are not long-lived

IPM Options

Cultural

Manual

Mechanical

Chemical

Sanitation and Competition

Manual and Mechanical Methods

- Pulling
  - excellent option for small numbers
  - Must bag plants
  - Wear gloves

- Mowing
  - Incomplete control
  - Plants will partially recover
  - Damage can accelerate flowering
  - Most effective later in the season
  - Best done twice

Chemicals:
Preemergence

- Need to know boundaries of population
- May be growing in sites that cannot be sprayed

- Aminopyralid (eg: Milestone)
- Aminocyclopyrachlor (eg: Method)
- Clopyralid (eg: Transline)

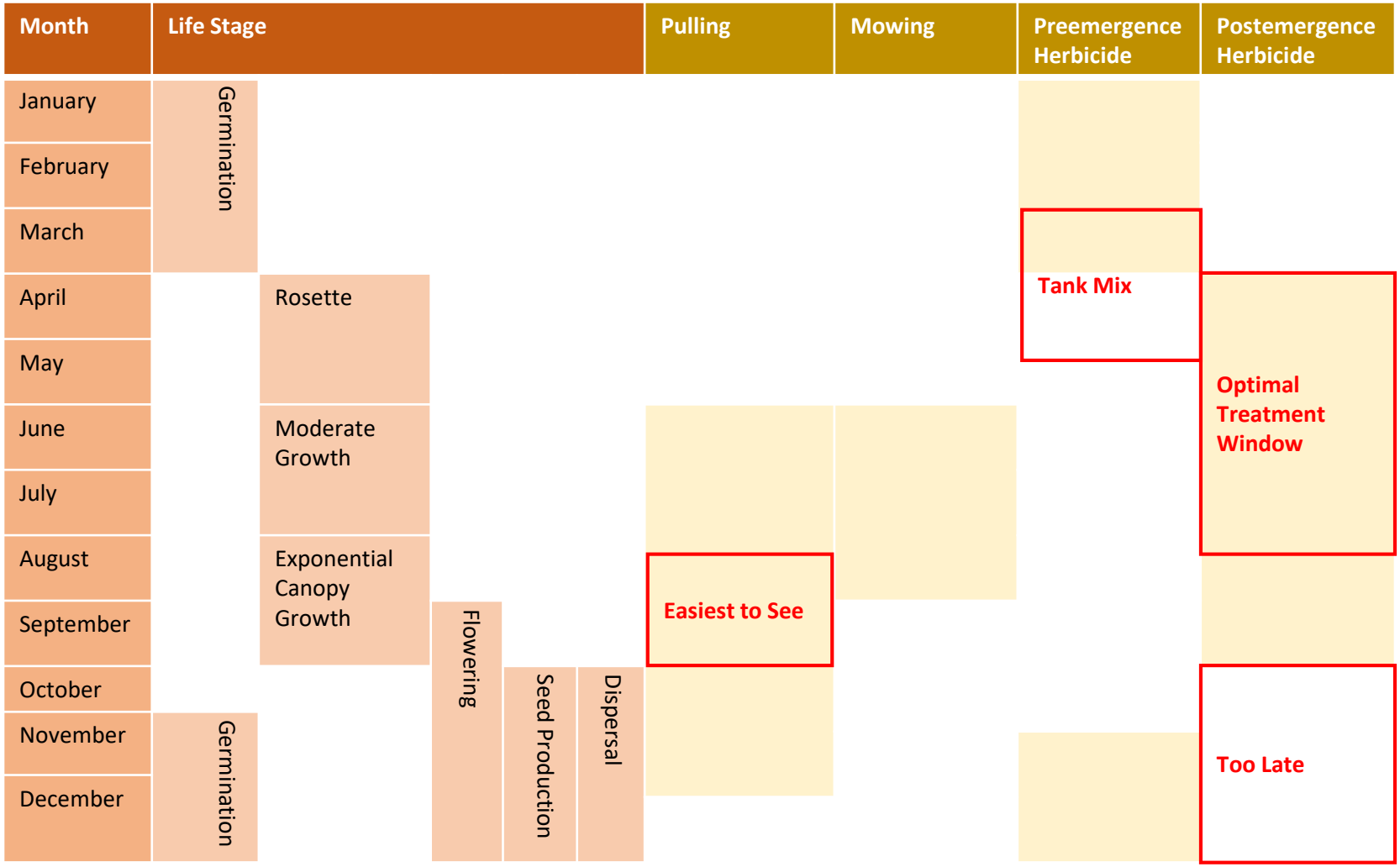
Chemicals:
Postemergence

- Most effective on young, healthy plants
- Surfactant recommended
- Becomes less effective as growth increases and flowering begins

- Glyphosate (eg: Roundup products)
- Triclopyr (eg: Garlon products)

- Multiple treatments increase control
  - Winter
  - Spring or Summer

Effective treatment timing to control Stinkwort



At Pinnacles

- Reservoir
- South Chalone Creek
- Partner Property


Questions?

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.