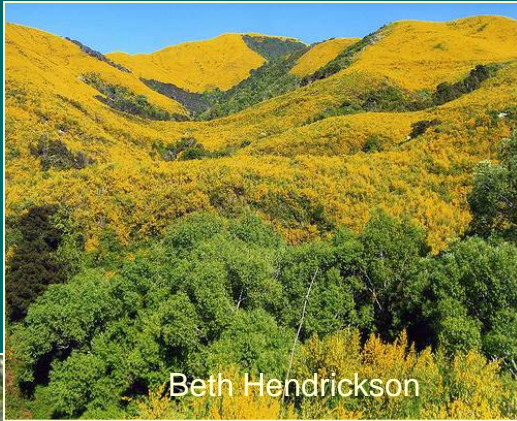




# Impacts of California's invasive plant species on invertebrate fauna: A review

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# Which invasives to manage?



# Invertebrates: Critical components of ecosystem function and biodiversity



# Cal IPC's Plant Assessment Form

192 taxa reviewed

Table 2. Criteria, Section, and Overall Scores

1.1	Impact on abiotic ecosystem processes	A	Rev'd, Sci. Pub'n
1.2	Impact on plant community	A	Rev'd, Sci. Pub'n
1.3	Impact on higher trophic levels	A	Rev'd, Sci. Pub'n
1.4	Impact on genetic integrity	D	No Information

**"Impact"**  
Enter four characters from Q.1.1-1.4 below:  
**AAAD**  
Use matrix determine the score; enter below:  
**A**

2.1	Role of anthropogenic and	A	3	Rev'd, Sci. Pub'n
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**"Invasiveness"**  
For questions at left, recall that an A gets 3 points, a B gets 2, a C gets 1, and a D or U gets=0. Enter the sum total of all points for Q.2.1-2.7 below:  
**17**  
Use matrix to determine score and enter below:  
**A**

**"Plant Score"**  
Using matrix, determine the Overall Score and Alert Status from the three section scores and enter them below:  
**High**  
**No Alert**

## Part IV. Plant Assessment Form

For use with "Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands" by the California Exotic Pest Plant Council and the Southwest Vegetation Management Association

Table 1. Species and Evaluator Information

Species name (Latin binomial):	<b>Tamarix ramosissima, T. gallica, T. chinensis</b>
Synonyms:	<i>Tamarix pentandra</i> for <i>T. ramosissima</i>

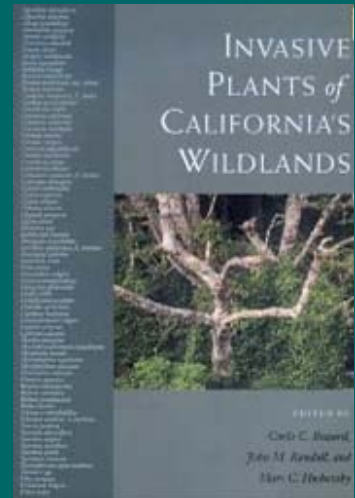
2.7	invaded	C	1	Other Pub. Mat'l
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3.1	Ecological amplitude	A	Other Pub. Mat'l
3.2	Distribution	B	Other Pub. Mat'l

**"Distribution"**  
Use matrix determine the score; enter below:  
**A**

# Additional references:

- Bossard et al., “Invasive Plants of California’s Wildlands”
- Duncan and Clark, “Invasive plants of range and wildlands and their ...impacts”
- Other studies opportunistically gathered



# Adjustments and Guidelines...

*Not enough information:*

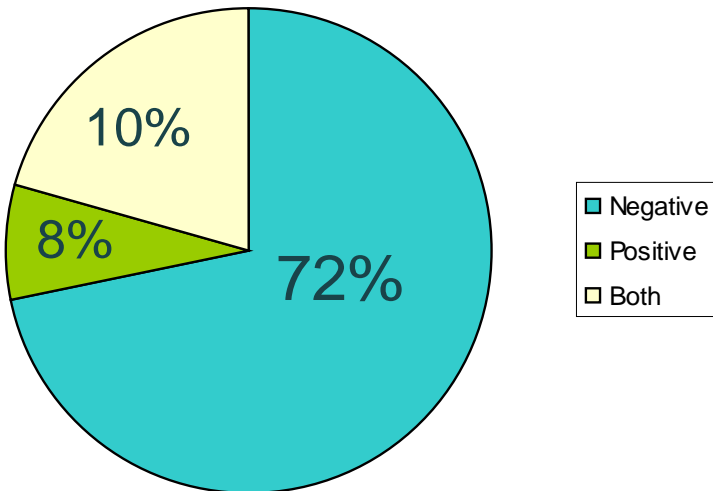


- “Reduces native habitat”
- Mere honeybee use
- General user comments

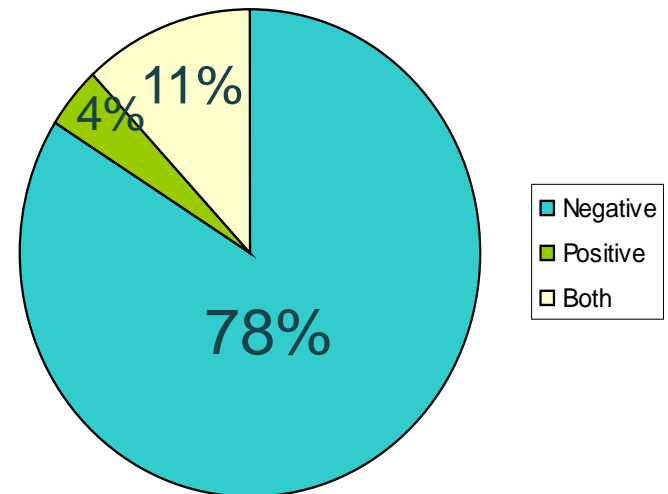
# Summary Results

- 23% of taxa had invertebrate information

For these 39 taxa:



*Reviewed scientific publications only:*



# The Classic Comparison: *Ammophila arenaria*

(Slobodchikoff & Doyen 1977)

As *Ammophila*  
↑ Arthropod  
diversity ↓



Even a low %  
of *Ammophila*  
↓ arthropods

- Extra bad for dune beetles (*Coelus ciliatus*)
- *Ammophila* impeding movement?



# The Census:

*Silybum marianum*, *Salsola kali* (tragus)

(Goeden & Ricker 1968, Goeden 1970  
UC Riverside Biocontrol; USDA)

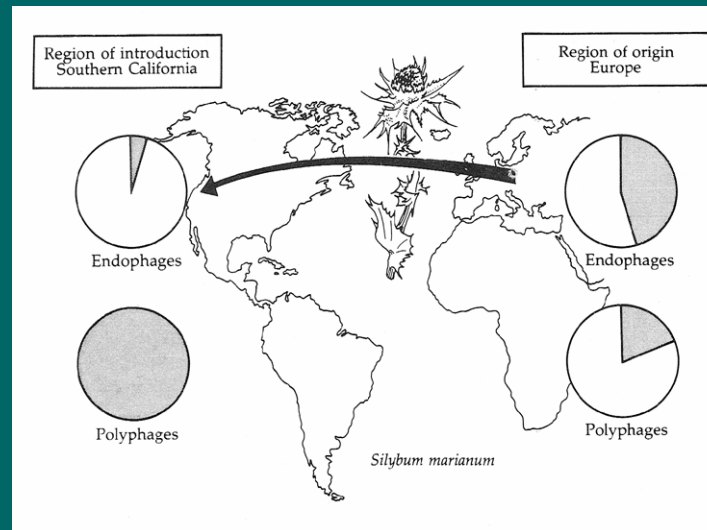


Figure from Strong et al. 1984



*Mostly Generalists, Pests*

# The Double Negative:

## *Arundo donax*

Herrera & Dudley 2003, Going & Dudley 2008



- 2003: comparative
  - ↓ arthropod abundance, richness, biomass in *Arundo*
  - ↑ non-native isopods
- 2008: experimental
  - ↓ caddisfly growth & survival

# The Mixed Bag: *Tamarix* spp.

Horton & Campbell 1974; Egan et al. 1993; Carothers et al. 1976; Anderson 1994; Ellis et al. 2000; Bailey et al. 2001; Going & Dudley 2008

- Increases abundance of ground arthropods
- Decreases abundance of aquatic macroinvertebrates
- Causes reproduction to fluctuate
- Alters emergence time
- Decreases richness
- Increases larval biomass



Cnpsci.org

# All Bases Covered:

## *Cortaderia jubata*

(Lambrinos 2000)

- Fewer bees/wasps, true bugs; more spiders
- Lowers arthropod diversity and abundance
- Potential causes:
  - Altered plant composition?
  - ↓ plant architectural complexity?



# The Alien Liaison:

*Cytisus scoparius*

Simpson et al. 2005



- Obligate outcrosser
- Flowers must be tripped for seed set
- Only honeybee can do it (in Australia)



# Compared to the Origin: *Cardaria draba*

Cripps et al. 2006

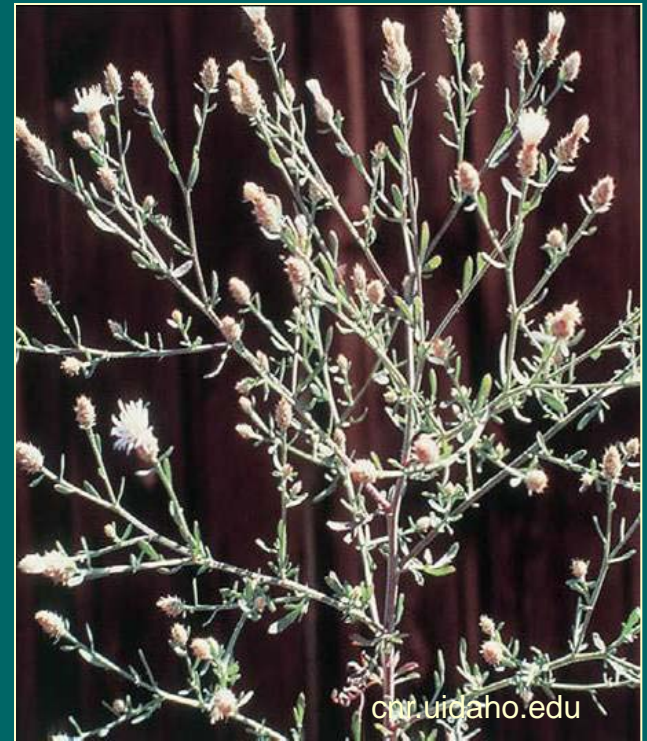
- Arthropod richness, diversity ↓ introduced range
- Generalists ↑ introduced range
- No root feeders & gall formers
- Herbivore abundance ↑ introduced range



# The Taste Test:

## *Centaurea diffusa*

- Grasshoppers preferred a native *Sisymbrium* (Fielding et al. 1996)
- *Centaurea* extracts inhibited larval growth of cutworms (Salloum & Isman 1989)





# The Pest Attractors:

*Verbascum thapsus* & *Cirsium arvense*

Maw 1980, Horton  
& Lewis 2003



Hosts for crop  
pests like  
mullein leaf  
bugs and  
bean aphids

Moore 1975



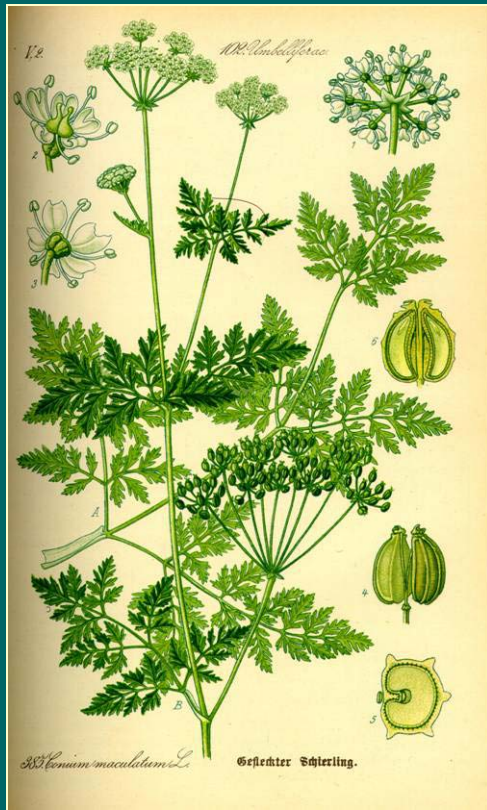
*Human value...*



# The Toxic Two:

## *Conium maculatum*

“Toxic to all organisms”



[commons.wikimedia.org](https://commons.wikimedia.org)

## *Delairea odorata*



[lurig.altervista.org](http://lurig.altervista.org)

- Alkaloids kill spiders and aquatic insects
- Sequestered by monarchs

# The Cadillac:

*Spartina alterniflora* x *foliosa*

(Brusati & Grosholz 2006, 2009)

- Both comparative & experimental methods
- Invasive hybrid ↓ density & biomass of invertebrate fauna
  - Too much biomass?
- 4x amount of detritus, but not incorporated into the food web



# Summary

- Many approaches (censuses, comparisons, experiments...)
- Many metrics (abundance, biomass, reproduction/growth, diversity, composition, function, facilitation of other invaders, food webs)



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Thomas Shahan



Duane Harland



Thomas Shahan

# Conclusion

- Most of the time, negative impact
  - Not always consistent
- Composition & function can be key

# Recommendations

- Beyond abundance and diversity:  
Composition, function, food webs



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