Herbicide control of fig trees in riparian habitats:
Evaluation of control efficacy and off-target effects

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• Background on invasive fig
  Why try to eradicate it?
• Control efforts at Caswell Memorial State Park
  Problems → research question
• Experiment
  Efficacy results
  Off-target results
• Management conclusions
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**Ficus carica**

- Common edible fig → grown in commercial orchards
- Invasive in riparian habitats → exceedingly dense groves
- Series of vegetation surveys:
  1. Reduces community diversity
  2. Simplifies community physiognomy
  3. Area occupied by fig expands rapidly after long lag
Cumulative area under fig canopy: Caswell Memorial State Park

Fig should be eradicated from Central Valley riparian habitats
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Control efforts at Caswell Memorial State Park

- Basal bark treatment with 25% Garlon 4 (triclopyr)
- Low mammalian toxicity
- Average half-life of 30 days in soil (moderate rate)
- When exposed to sun, has a half-life of 3-4 days due to photolysis
Problems with herbicide residues in soil?

Very little natural regeneration of native plants at ex-fig sites

Soils from sprayed fig sites caused 70-100% transplant mortality

- Soil residues: 3-6 ppm triclopyr 12+ months after spraying
- Sensitive plants affected by triclopyr at 0.03 ppm (vigor) and 0.3 ppm (germination)
Research question: Does basal bark treatment of invasives that have high stem densities result in an over-application of herbicide?

- Few trees per acre → low levels of herbicide
- Many trees per acre → high levels of herbicide
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Experimental Design

1. Six large, dense fig groves
   – Hatfield and McConnell SRAs

2. Basal bark with 25% Garlon 4
   – Amount applied (kg ae/ha)

3. Collected soil six months after spraying
   – Both <0.5m (near) and >0.5m (far) from fig stems
   – Tested soil for triclopyr

4. Planted native plants in fig groves and control sites six months after spraying

5. Tested other herbicide treatments – possible to control fig with less herbicide?
Results – control efficacy of other treatments

1. Limited basal bark:
   Garlon 4 [25%]
   20-40% of stems treated
   
   Killed an average of only
   66% of the trees per grove

2. Foliar applications:
   Roundup [2%]
   Roundup [2%] + Garlon 3a [1%]
   
   Killed only top 1-2 meters
   of branches

3. Hack and squirt:
   Girdled trunks
   Roundup [100%]
   
   Killed saplings, but not
   trees over 3” diameter
Results – control efficacy of basal bark treatment with 25% Garlon 4

Very effective control
99+% reduction in fig grove canopy cover
Bark sloughing off trees one year later
Results – off-target effects of basal bark treatment with 25% Garlon 4

1. Application rates:
   - 27 - 40 kg ae/ha (34.0 ± 6.4)
   - Foliar spray rates usually 3-4 kg ae/ha

2. Triclopyr residues 6 months after spraying:
   - Near stems (<0.5 m) = 1.38 - 6.64 ppm (3.2 ± 1.9)
   - Far from stems (>0.5 m) = 0.06 - 0.60 ppm (0.28 ± 0.2)

Garlon 4 translocating off of fig trunks
- Overspray
- Release from roots
- Stem flow during precipitation

Photolysis not occurring
Results – off-target effects of basal bark treatment with 25% Garlon 4

1. Application rates:
   - 27 - 40 kg ae/ha (xx ± xx)
   - Foliar spray rates usually 3-4 kg ae/ha

2. Triclopyr residues 6 months after spraying:
   - Near stems (<0.5 m) = 1.38 - 6.64 ppm (xx ± xx)
   - Far from stems (>0.5 m) = 0.06 - 0.60 ppm (xx ± xx)

3. Native plant mortality:
   - 0 - 16% (6.2 ± 6.3)
   - Not significantly different from controls
   - All dead plants were near (<0.5m) multiple stems
   - Much lower mortality than we observed at Caswell
     - Floods; warm and wet winter
     - Stem density?
Lower density fig invasions
- Less herbicide applied
- Small proportion of grove area near stems
Higher density fig invasions

- More herbicide applied
- Large proportion of grove area near stems
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Management Conclusions

1. Fig needs to be eradicated from riparian preserves
   • Inflicts detrimental impacts
   • Eventually spreads rapidly

2. Alternate herbicide treatments were not effective
   • Other potential options - stem injection, basal bark
     but with lower herbicide concentration

3. Basal bark treatments with 25% Garlon 4 effective
   • But use a lot of herbicide
   • Can create high soil residues many months later

4. Garlon 4 residues can affect restoration efforts
   • Damage depends upon amount of herbicide used,
     which in turn depends upon stem density
   • Apply with caution!
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