Conservation Perils from Marijuana Cultivation on Public Lands in California

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Integral Ecology Research Center
Collaborative Efforts

- Interdisciplinary approach
- Working with Federal, State, Academia and NGOs “Out of the Box” approach.
What does Marijuana Cultivation look like on Public Lands?
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Trinity Alps Wilderness
Marijuana Cultivation: A Threat to Conservation?

Common Assumptions

- “Mom and Pop” grows
- Organically grown
- “It’s just a plant”
Like any activity, if reducing production costs can be exploited, many will take advantage of this quickly and as furiously as possible, before that opportunity is gone.
Hardin’s (1968): *Tragedy of the Commons*

“individuals that act independently in their own self-interest, will ultimately deplete a shared limited resource even when it is clear that it is not in anyone's long-term interest for this to happen.”

“benefits and costs for utilizing these shared resources are not equally distributed”
Why California?

California: Template for Initiating Scientific Solutions

- 60-70% of the nation’s marijuana cultivation
- Large amounts of public and tribal lands (55-60% of CA production)
- 2nd largest number of ESA listed species (320 species)
- Cultivation conflicts with numerous groups
Natural Resource Exploitation

- Water
  - Diversions

- Forest
  - Fragmentation

- Wildlife
  - Contamination
Water
Public Land Water Diversion Rates

6-8 gallons a day

150 days

900 - 1,200 gallons per plant/season
# Public Land Water Diversion Rates: California

* 1,200 gallons per plant, full season

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Plants</th>
<th>Water Diversion</th>
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</thead>
<tbody>
<tr>
<td>2012</td>
<td>~870,000</td>
<td>1.04 billion</td>
</tr>
<tr>
<td>2013</td>
<td>~500,000</td>
<td>600 million</td>
</tr>
<tr>
<td>2014</td>
<td>+500,000</td>
<td>600 million</td>
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</tbody>
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Each Year: Amount of San Francisco households uses: 3 weeks to +1 month
6-8 gallons a day, per plant

Is 6-8 gallons a day realistic?

- **Evapotranspiration**
  - Native porous soils
  - Evaporation from soil surface
  - Evaporation from plant leaves (transpiration)
- **Climate**
  - solar radiation, temperature, humidity, wind
- **Plant**
  - Stage of growth, health of the plant
Impacts to Aquatic Organisms from Water Diversions

- Loss of habitat
- Higher water temperatures
- Increase susceptibility to diseases
- Decrease prey availability for aquatic and terrestrial wildlife
Forest Fragmentation
Facilitate increased erosion & sedimentation rates

Removal of habitat for species of conservation concern
Critical Habitat or Wildlife Lost from Grow Site Initiated Fires

2006-2014

- Confirmed 110,235 acres

Total cost > $55 Million

Suppression Cost Only
Can these grow sites facilitate an increased risk to conservation concerned species?

- Predation on fisher, American marten, Humboldt marten
- Predation #1 mortality factor; $\geq 70\%$ of all mortality
- Bobcat is the #1 predator

Why such a high rate of predation?
Could these trails heighten predator movement within and between these sites?
Fisher (*Martes pennanti*): Forest specialist mid-sized carnivore

USFWS: **Proposed for listing under the Endangered Species Act**

- 79% CA fishers exposed
- 4 mortalities

Post-PLoS (mid 2012 - 2014)

- 86% CA fishers exposed
- 9 new mortalities
- Total of 13 fisher deaths

57% Increase of Cases
Impacts of rodenticide and insecticide toxicants from marijuana cultivation sites on fisher survival rates in the Sierra National Forest, California

- AR Exposed Females: 4 sites vs. non-exposed: 0.67 sites
Impacts of rodenticide and insecticide toxicants from marijuana cultivation sites on fisher survival rates in the Sierra National Forest, California

- AR Exposed ♀ highest: 16 sites vs. non-exposed: 1 sites
Supply Creek Trespass Marijuana Garden:

Trail cameras at garbage and toxicant dump areas

Hoopa Tribe

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July 2013: “Hot Dog” Fisher

- Small Grow, < 400 plants
- Case of poisoning with “Restricted Use” pesticide.
  - Hot dog laced with carbamate insecticide.
  - Found dead less than 20m from small grow site.
Will the Recent Anticoagulant Restrictions Help?

Replacement rodenticides taking their place

**BROMETHALIN** (Neurotoxicant)
- Flavorized
- No Antidote
- Very difficult to interpret (pathology)

Recent Grow (2014) had 24 pounds of Bromethalin
Hoopa Tribe
Fisher Demographic Study

Short video of a suspected toxicosis case in a fisher
(Martes pennanti)
Could prey abundance decline due to pesticides?

&

Could this be affecting wildlife species indirectly?
Response of carnivores that depend on this prey can take many forms.

- Expand home range to encompass more prey opportunities, increased movement, encounter more predators.
Male Fisher Home Range
Female Fisher Home Range
Bobcat Home Range
• Past studies; prey ↓ bobcat ↑ home range, 200-500%

• 200% ↑ lead to increased interaction probability w/ bobcats?
2010 - 2011

- ~1,100 trespass grow sites eradicated
- Liberally, only 40 - 60% sites are discovered.
- Only a fraction are cleaned.
- Sites have the potential to impact 30 - 35% of fisher’s current range.
Private Land
Barred Owls: Proxy for the Northern Spotted Owl

- GDRC 34 of 84 (40%) owls were positive
- Hoopa 44 of 71 (62%) owls were positive
- All positive owls were exposed to 2nd Gen ARs
**Invertebrates: Is the food web contaminated?**

- A total of 13 invertebrates were pooled into four (4) samples.
  - All four (100%) pools were positive for ARs.
  - Yellow-spotted millipede (*Harpaphe haydeniana*):
  - Pacific sideband snail (*Monadenia fidelis*)
  - Grasshopper (suborder Caelifera)
  - Ground beetles (family Carabidae)
How contaminated are these sites?

**Soil Testing:** Pesticides (OP, Carbamates and ARs)

- Submitted 2 out of 7 grow site samples
  - One grow site negative
  - One grow site positive for Difethialone (2nd gen AR)
    - DIF was not discovered at the site the year sampled

- Soil Ecology: Diazotroph ecology
  - N fixing bacteria
Game Species Contamination

Can game species humans consume be exposed to these toxicants?

- Yes

Can humans who consume their meat be exposed?

- Investigation ongoing
  - US Forest Service and Mule Deer Foundation
This issue is not new but the research is in its infancy.

A lot of data has been generated in the past 3 years!
Removing These Threats to Wildlife

October 2014, Number of trespass sites cleaned: 7

Personnel per day: 50 (25 Officers & N. Guard; 25 Sci. Team & Volunteers)

Total water diversion restored to watersheds: 67.5 million gallons

Total amount of fertilizer used at sites: 8,188 pounds

Total amount of rodenticide used at sites: 128 pounds

Insecticide used at sites: 560 gallons of usable insecticide

Carbofuran used at sites: 68 ounces concentrated carbofuran

Garbage removed: >8,000 pounds

Irrigation pipe removed: >8.5 miles
Barriers and Solutions

Support for more Science-based Information

• Inform agencies, managers and policy-makers.
• Educate the public on this issue.

Safety

• Scientists and Law Enforcement

Create Mechanisms of Support

• Support to document, test and analyze samples
• Remediation to remove these threats
Thank You

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