
What Would Aldo Think?

Using Herbicides to Control Invasive Weeds

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Aldo Leopold

- Early 20th Century wildlife biologist
- The Father of US Wildlife Management
- Author of *A Sand County Almanac*



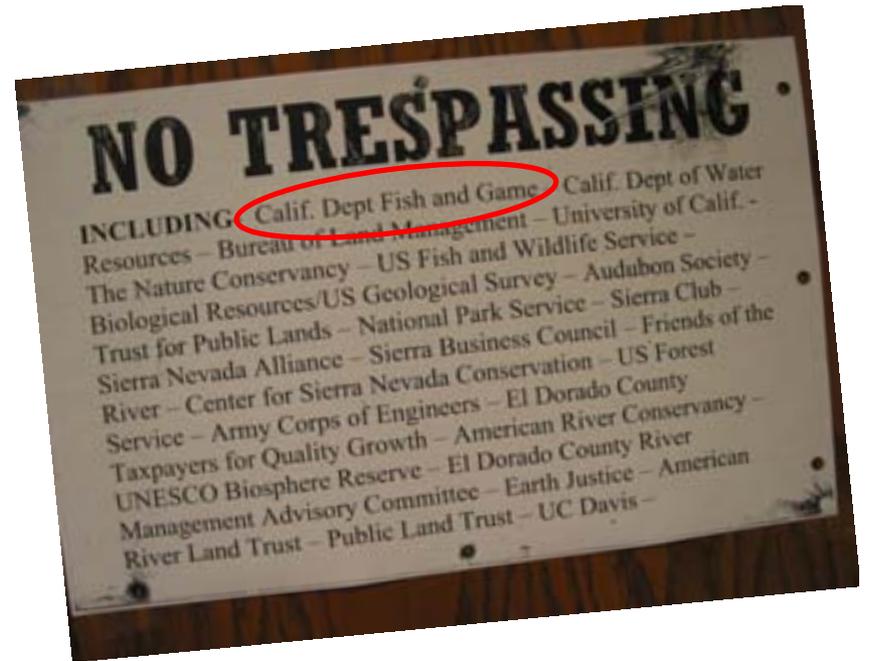
Aldo Leopold

- “A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.”

Aldo Leopold... A Sand County Almanac 1949

Another Aldo Quote....

- "obey the law, vote right, join some organizations and practice what conservation is profitable on your own land; the government will do the rest."



Invasive Species are a Serious Problem

- Invasive weeds cost CA \$82 million/year
- 42% of Federal T/E species are threatened by invasive species
- With an estimated rate of spread of 14% per year, infestations can double in size every 5 years.



Weedy Advantages

- Opportunistic
 - Prolific seed producers
 - Long seed life
 - Asexual reproduction
 - Allelopathic
 - Massive underground root or rhizome systems
-

A Logical Extension

- If invasive weeds are an ecological evil, then **NOT** managing them is irresponsible.
 - Further, not using the best available methods is equally irresponsible
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Best Available Methods of Control

- Most Effective
- Low Risk to the Environment
- Affordable



What's In Our Tool Box?

- Manual Control
 - Grazing
 - Mowing
 - Disking
 - Fire
 - Flooding
 - Biological Control
 - Herbicides
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Top Kill Only

- Manual Control
- Grazing
- Mowing
- Disking
- Fire



Site Restrictions



- **Grazing**
 - **Fire**
 - **Flooding**
-

We Surrender

- Grazing
- Biocontrol



Ah.... I see where he's headed....

- Herbicide use often addresses the limitations of other control methods
 - Few real regulatory or site restrictions
 - Systemic herbicides solve the “top kill” problem
 - Soil Activity
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Herbicide Disclaimer

- They're not a panacea
- Subject to human error
- Cost
- Herbicide Resistance
- Non-target plant hazard



A Mindset Problem...

Herbicides should be used only as a last resort.

If they're truly the best control method, why are we thinking of them as a last resort?

The Last Resort

- They're bad for the environment
- They're not natural
- Philosophical opposition
- They're poisons
- Not enough is known about them



Legitimate Questions

- They're poisons
- There are data gaps



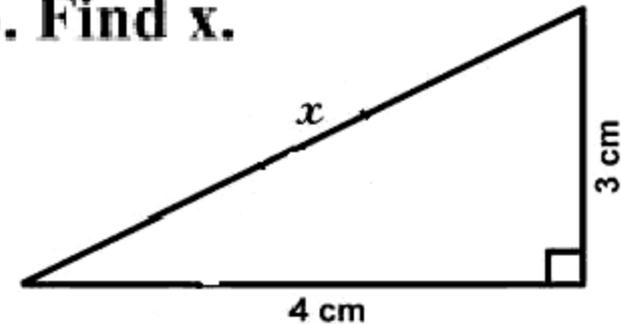
Invasive Weed Herbicides

- Glyphosate
 - Triclopyr TEA
 - Triclopyr BEE
 - Imazapyr
 - Chlorsulfuron
 - Clopyralid
 - Aminopyralid
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Data Gaps... Not Enough is Known

- 90 to 100 tests
- \$10 million*
- 9 to 10 years.

3. Find x .

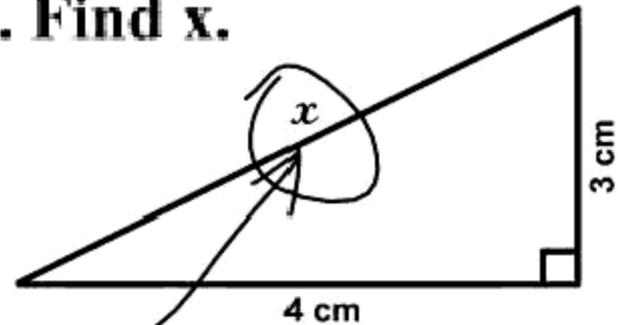


*Total, including in-house R/D, \$50 million.

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Here it is

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Required Studies

Terrestrial and aquatic nontarget organisms

- 2 avian oral LD50
 - 2 avian dietary LC50
 - 2 avian reproduction studies
 - 2 freshwater fish LC50
 - 1 freshwater fish early-life stage
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Required Studies

Terrestrial and aquatic nontarget organisms

- 1 freshwater invertebrate EC50,
 - 1 honeybee acute contact LD50,
 - 1 freshwater invertebrate life cycle, and
 - 3 estuarine acute LC50/EC50 studies
fish, mollusk and invertebrate.
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Conditional Studies

- Wild mammal toxicity
 - Simulated field studies (fish, bird or mammal)
 - Fish life cycle
 - Aquatic biomagnification
 - Sediment toxicity tests (aquatic invertebrates)
 - Additional honeybee tests
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Conditional Studies

Non-target Plants

- Seedling emergence
- Vegetative vigor
- Aquatic plant growth



Non-Target Wildlife Risk

	Mammals	Fish	Birds
Telar® 75% chlorsulfuron	Practically non-toxic	Practically non-toxic	Practically non-toxic
Transline® 40.9% clopyralid	Practically non-toxic	Practically non-toxic	Practically non-toxic
Habitat® 28.7% imazapyr	Practically non-toxic	Practically non-toxic	Practically non-toxic
Milestone® 40.6% aminopyralid	Practically non-toxic	Practically non-toxic	Practically non-toxic

Non-Target Wildlife Risk

	Mammals	Fish	Birds
Garlon® 3A 44.4% triclopyr TEA	SLIGHT	Practically non-toxic	Practically non-toxic
Roundup Pro® 41% glyphosate	Practically non-toxic	MODERATE	Practically non-toxic
Garlon® 4 41.6% triclopyr BEE	SLIGHT	HIGH	SLIGHT

Adding Some Perspective

- Triclopyr BEE (Garlon® 4)
- Triclopyr BEE is more toxic than Garlon® 4
- Slightly toxic to mammals (oral)
- $LD_{50} = 650 \text{ mg/kg (ppm)}$
- Exposure estimates* = 0.3 mg/kg/day

* Consumption of treated foliage by mammals. Application rate of 1 lb a.e./acre. USFS 2003.

Hazard Quotient Calculation

Triclopyr BEE

- $HQ = \frac{\text{exposure estimate}}{\text{toxicity}}$
- Exposure estimate = 0.3 mg/kg/day
- Toxicity value = $LD_{50} = 650 \text{ mg/kg}$

$$\frac{0.3 \text{ mg/kg}}{650 \text{ mg/kg}} = 0.0005$$

($HQ < 0.5 = \text{no acute hazard exists}$)

Chronic Exposure Scenario

- 90-day exposure
- 10-100% of diet assumed to be contaminated
- HQ = 3-6
- HQ Estimates <1-10 = moderate risk



A Few Things to Consider re: Chronic Exposure Risks

- Is the herbicide persistent?
- Are there repeated applications that result in “chronic” residues?
- Would wildlife consume the treated plants?



Are Herbicides the Best Available Method of Control?

- Most Effective?
 - Low Risk to the Non-target Environment?
 - Affordable?
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Questions?

