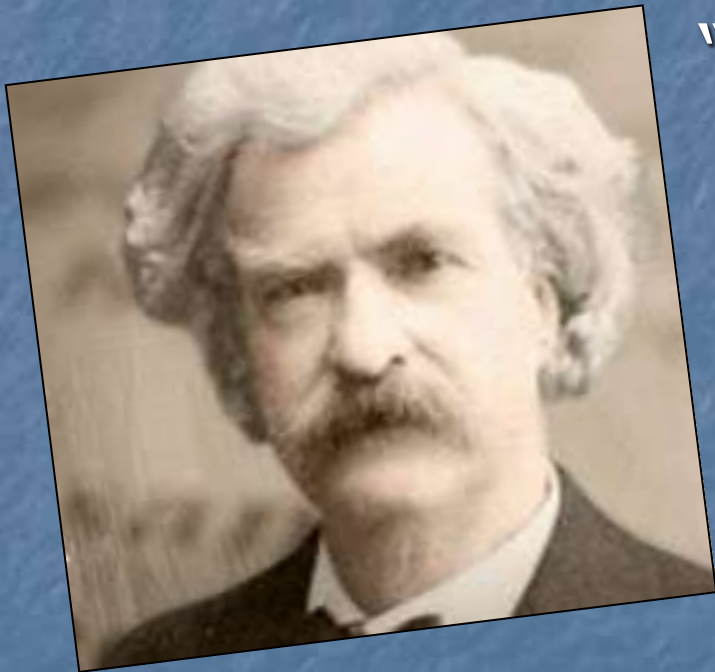


The Butterfly Effect: Herbicides & Invertebrates

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Quotable Quotes

Mark Twain

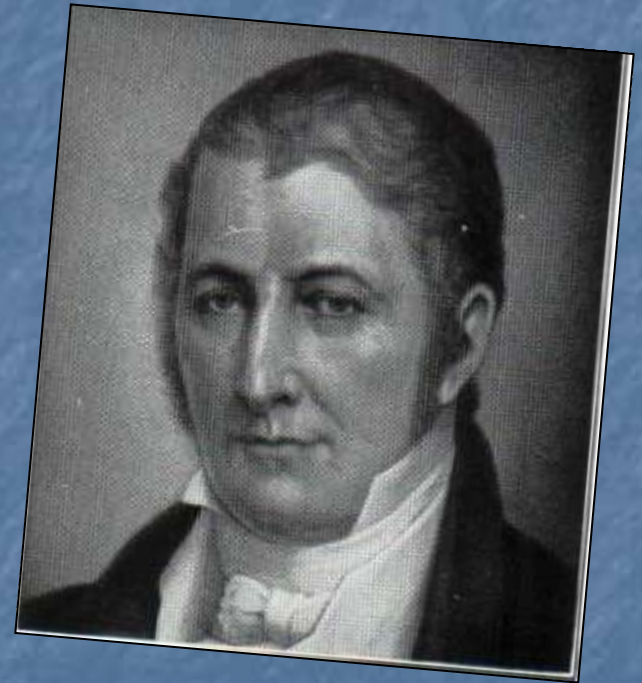


“ He has been a doctor a year now and has had two patients, no, three, I think - - yes, it was three; I attended their funerals.”

Quotable Quotes

Francis Bacon

“Its like calling a doctor that you expect can cure your disease but since he doesn't know much about your body he prescribes a medicine that cures the disease but ends up killing you.”



The Problem

- The control strategies we use to reduce the ecological impacts caused by invasive weeds also pose some level of ecological risk.

- Fire
- Disking
- Mowing
- Hand-removal
- Biocontrol
- Herbicides



The Problem



- But our solutions to this problem are often...
 - Biased
 - Non-scientific
 - Silly

Weeds, Herbicides & Butterflies

- Winter 2012 Cal IPC newsletter article
 - Antioch Dunes NWR
 - Lange's metalmark butterfly *Apodemia mormo langei*
 - The host plant... naked stem buckwheat *Eriogonum nudum psychicola*
 - The villains...
 - winter vetch *Vicia villosa*
 - yellow starthistle *Centaurea solstitialis*
 - ripgut brome *Bromus diandrus*



Herbicides & Butterflies

- J.D. Stark University of Washington; Environmental Pollution 164 (2012) 24-27
- evaluated potential toxic effects on Behr's metalmark, a close relative of Lange's metalmark.
- First instars caterpillars were used
- "Field level" rates of...
 - Triclopyr ester (Garlon 4)
 - Sethoxydim (Poast)
 - Imazapyr emulsifiable conc (Stalker)
- Sprayed directly on caterpillars and their food plants

Herbicides & Butterflies

- Herbicide exposure thru direct spray and dietary routes reduced the number of adults that emerged from pupation (24-36%).
- The authors speculated that...
 - Because each herbicide has a different mode of action, the effects are due to inert ingredients or indirect effects on food plant quality.
 - Continued use of these herbicides at the site.. “may contribute to the decline of this species.”

It's not the data... it's the interpretation.

- Well-collected data is always good, but we have to be careful about our conclusions.
- Stark's study brings up several important points.
 - Let's be cautious about assuming that herbicides are safe *solely because they're herbicides*.
 - Few studies have studied the effects of herbicides on butterflies or any other invertebrates.

Insects & Herbicides

EPA only requires one terrestrial invertebrate toxicity study for pesticide registration...an acute contact honeybee test.



Honeybees? Butterflies? Whatever.

- are honeybees a suitable surrogate for assessing herbicide risks to other invertebrates?
- A review of the available bee contact test data for the three herbicides is less than convincing.
 - sethoxydim? "no significant impact."
 - triclopyr ester? "no impact"
 - imazapyr? "no impact"

.

What's going on here?

- Maybe the honeybee test isn't adequate for other invertebrates.
- These studies all used the active ingredients and not the formulation



What's going on here?



- With mammals and birds, the formulated products* are not much more toxic than the active ingredients alone.



- The results from fish tests, however, indicate a greater toxicological risk

* Poast, Garlon 4 and Stalker

Some Conclusions

- avoid using herbicides that have toxicity “red flags” for fish when invertebrates are involved.
- Use less “fish-toxic” formulations
 - Use Garlon 3A (amine) instead of Garlon 4 (ester)
 - Use Habitat (aqueous) instead of Stalker? (an EC)
 - Poast (80% naphthalene) can be replaced with another grass-specific herbicide with low fish toxicity Envoy (A.I. is clethodim)

Low Exposure = Low Risk

- avoid direct application or significant drift to sensitive invertebrate host plants.
 - Poast is harmless to naked stem buckwheat
 - Garlon 4 or Stalker? Lethal to broadleaf plants.
- make herbicide applications when the most sensitive life stage isn't present.
 - Caterpillar feeding exposure



S.F. Chronicle....

“What's clear is that other at-risk and endangered butterflies may also be in danger in places where weed killers are applied.”

Take Home Messages

- Assess herbicide product risk based on chemical-specific data (not lumping)
- Consider both toxicity and exposure when assessing non-target risk
- Read lots of studies but think about them critically
- Know what herbicide tools are available