Herbicides: minimizing impact and maximizing benefit for natural areas

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Wisconsin is blessed with unique natural areas

- Forests: 16 million acres
- Wetlands: 5.3 million acres
- Prairies: 12,000 acres

Natural areas are being impacted by invasive plants in Wisconsin

Invasive species

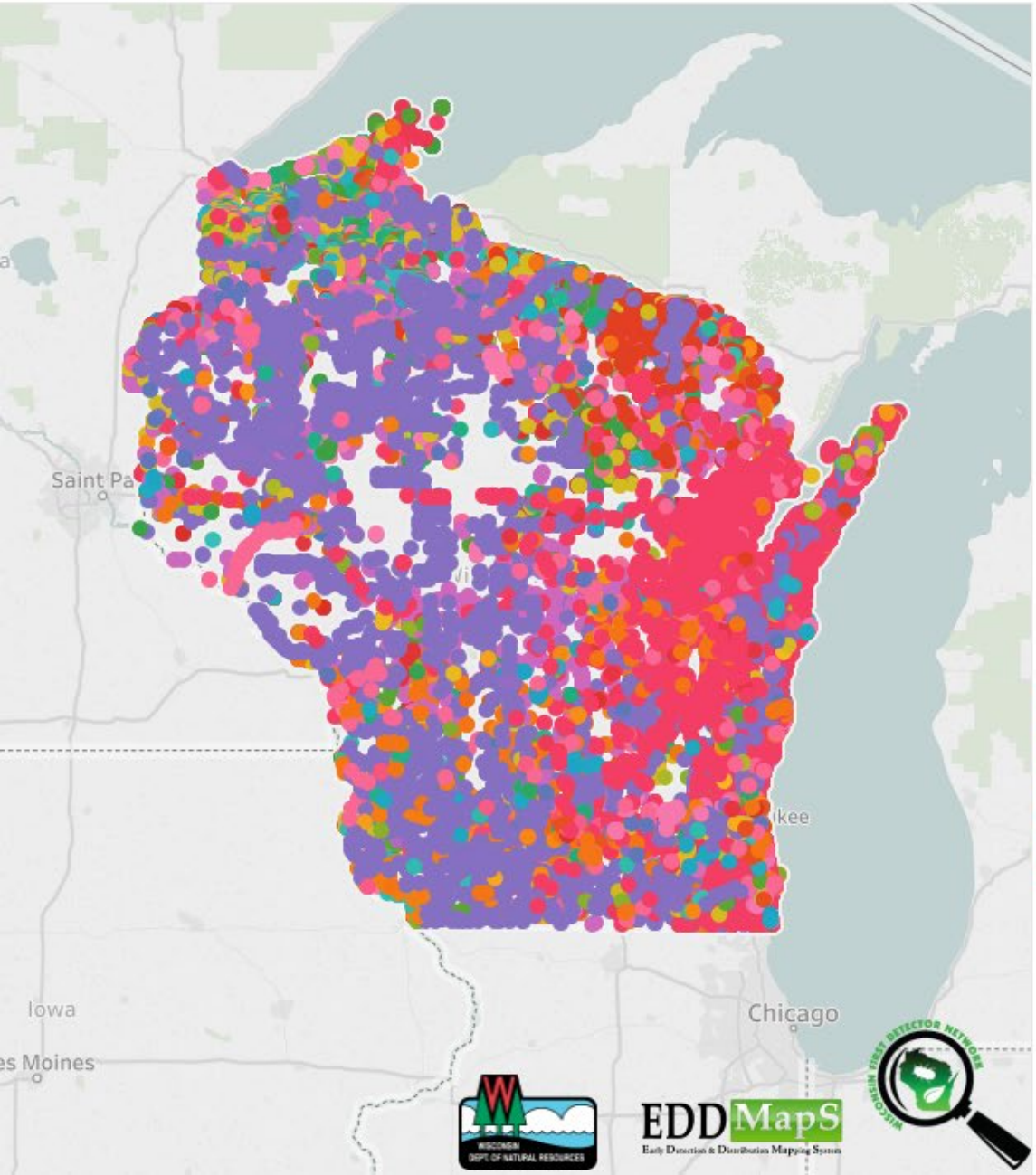
- Identified as the 2nd biggest threat to endangered species
- Regulated by NR40 to reduce the impact to Wisconsin's
  - Economy, environment and impact to human health

Common buckthorn

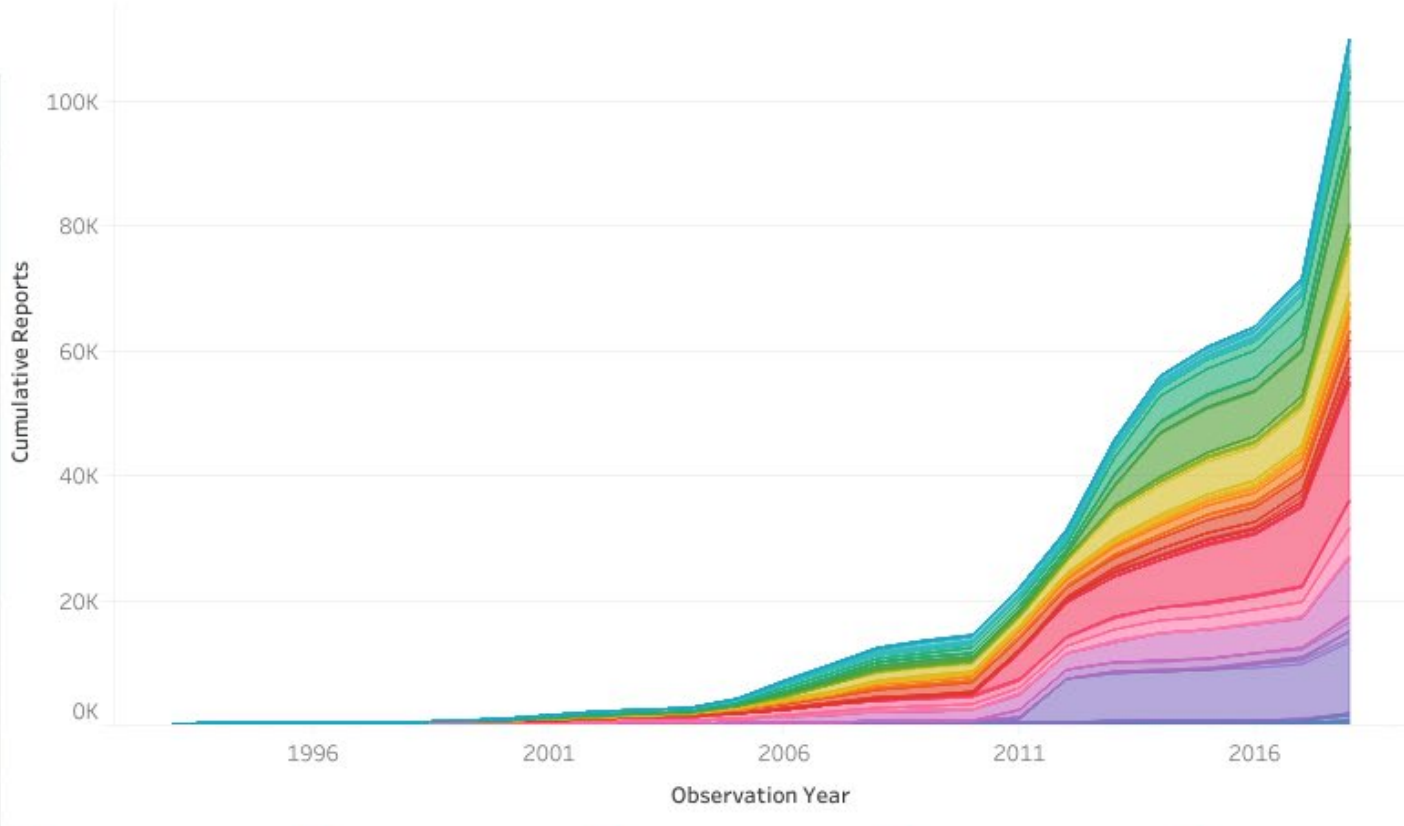
reed canarygrass

wild parsnip

Wisconsin Shared Terrestrial Invasive Plant Presence Viewer



Cumulative Number of Reports Over Time[1]



ABSINTH WORMWOOD
AMUR CORKTREE
AMUR HONEYSUCKLE
AMUR MAPLE
AQUATIC FORGET-ME-..
AUTUMN OLIVE
BABYSBREATH
BELLS HONEYSUCKLE
BIGLEAF LUPINE
BIRDSFOOT TREFOIL
BISHOPS GOUTWEED
BLACK ALDER
BLACK LOCUST
BLACK SWALLOWWORT
BLACKBERRY LILLY
BLUEBUTTONS
BOHEMIAN KNOTWEED
BRISTLY LOCUST
BROWN KNAPWEED
BURNET-SAXIFRAGE
BUSH HONEYSUCKLES ..
BUTTERFLY DOCK
CALLERY PEAR
CANADA THISTLE
CHEATGRASS
CHINESE YAM
CHOCOLATE VINE
COLTSFOOT
COMMON BARBEI
COMMON BUCKTH

Classification

All

Common Name

All

Observation Date Range

1992 to 2018
and Null values

[1]Due to internal policies, some wetland species locations are unable to be shared.

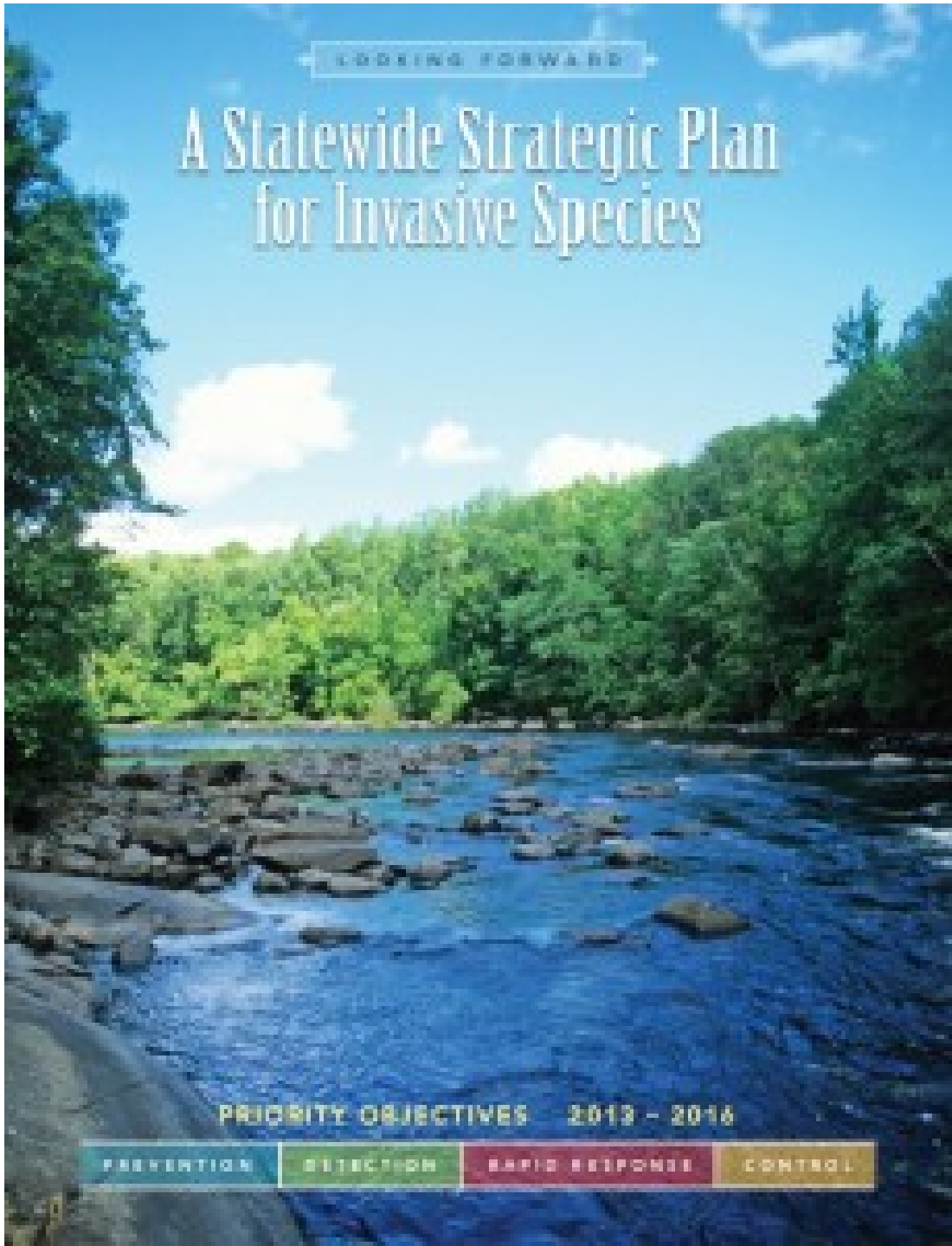
Last updated: 9/28/2018

All is not lost……

Many parts of WI are not invaded

- Efforts have been to
  - prevent further spread
  - minimize impacts

- Limited $$$ is available to conduct most of this work
  - Need to coordinate efforts



How do we manage invasive plants?

- Manipulation of the environment
- Physical/mechanical management
- Prescribed fire
- Biological control
- Herbicide

Often herbicides are used,

- Effective across a wide range of environments
- Cost effective compared to other techniques
- Many are selective or can be applied in a selective manner
  - Limits impact to desired plants

Garlic mustard cover and resulting plant richness

La Crosse, WI

	% Cover of Garlic mustard		Species Richness (plants/m2)	
	rosette	flower	total	native
Gly 2% spot	23	0	7.3	7.1 a
Gly broad	27	0	5.8	5.6 b
Ally broad	3	0	7.0	6.8 a
Handpull	14	0	5.6	5.4 b
UTC	39	0	5.5	5.3 b
Prob	0.03	ns	ns	0.09

I tried to eliminate this mulberry for 10 years with cutting sprouts……

Herbicides can harm the environment

- Injure desirable plants
  - On-site vs drift off site
- Contaminate water
- Harm wildlife/people

How do we make decisions on what is safe to use?

- Difficult as lots of information is on the internet
  - Not all is science-based
- Product instructions are complicated
  - Highly technical
  - Site specific restrictions
- All the potential impacts have not been researched
  - Impossible to measure all impacts, use surrogates

I recommend evaluating pesticides prior to use

- Is the pesticide effective for your situation/goals?
- What benefit does it’s use provide?
- What is the risk of exposure given your application method/frequency?

Does the use of the pesticide make your goal easier to achieve/attain?

- Compare with other techniques
  - Short and long-term effectiveness
  - Cost to apply
  - Expertise/tools available
  - Permits/licenses required
  - Fits the environment

Evaluate expected benefits and compare to your goals for land

- Determine benefit from using
  - Can you treat more acres?
  - Can you increase native plant habitat
  - Reduce the presence of plants that impact human health
  - Eliminate the need for annual treatments

Evaluate the risk of pesticide exposure

How much are you likely to be exposed to

- Determine the level of risk for your use:
  - Frequency of use
  - Amount used
  - Method of application (exposure)

Examples of high vs low risk pesticide use

HIGH Risk

- high toxicity substance
  - Environmental & Human Health
- Not using proper Personal Protective Equipment (PPE)
- Applying frequently
- Broadcasting,
  - applying in conditions where exposure is likely

LOW Risk

- Low toxicity substance
  - Environmental & Human Health
- Using proper Personal Protective Equipment
- Applying rarely
- Not broadcasting
  - Applying in conditions where exposure is NOT likely

Will use glyphosate as an example

- Herbicide discovered in 1950s, used since 1970's
  - Active ingredient in many herbicides (Roundup)
- Most widely used pesticide in United States
  - >250 millions lbs applied annually
  - Agriculture accounts for 90% use
  - Non-Agriculture accounts for 10% use
  - Recently implicated as a carcinogen

This is a challenging topic

- I will be using lots of technical terms/examples
  - Resources exist that explain these in more detail
- I will try to base comments on facts and limit my opinions
  - I have gotten my information from these sources
    - National pesticide information center (http://npic.orst.edu/)
    - Environmental Protection Agency
- If you have other facts you would like to share with the group, I will provide time at the end of my presentation
  - I will ask the source of this information

Lots of information is available that creates strong opinions

not all are based on facts….

One example

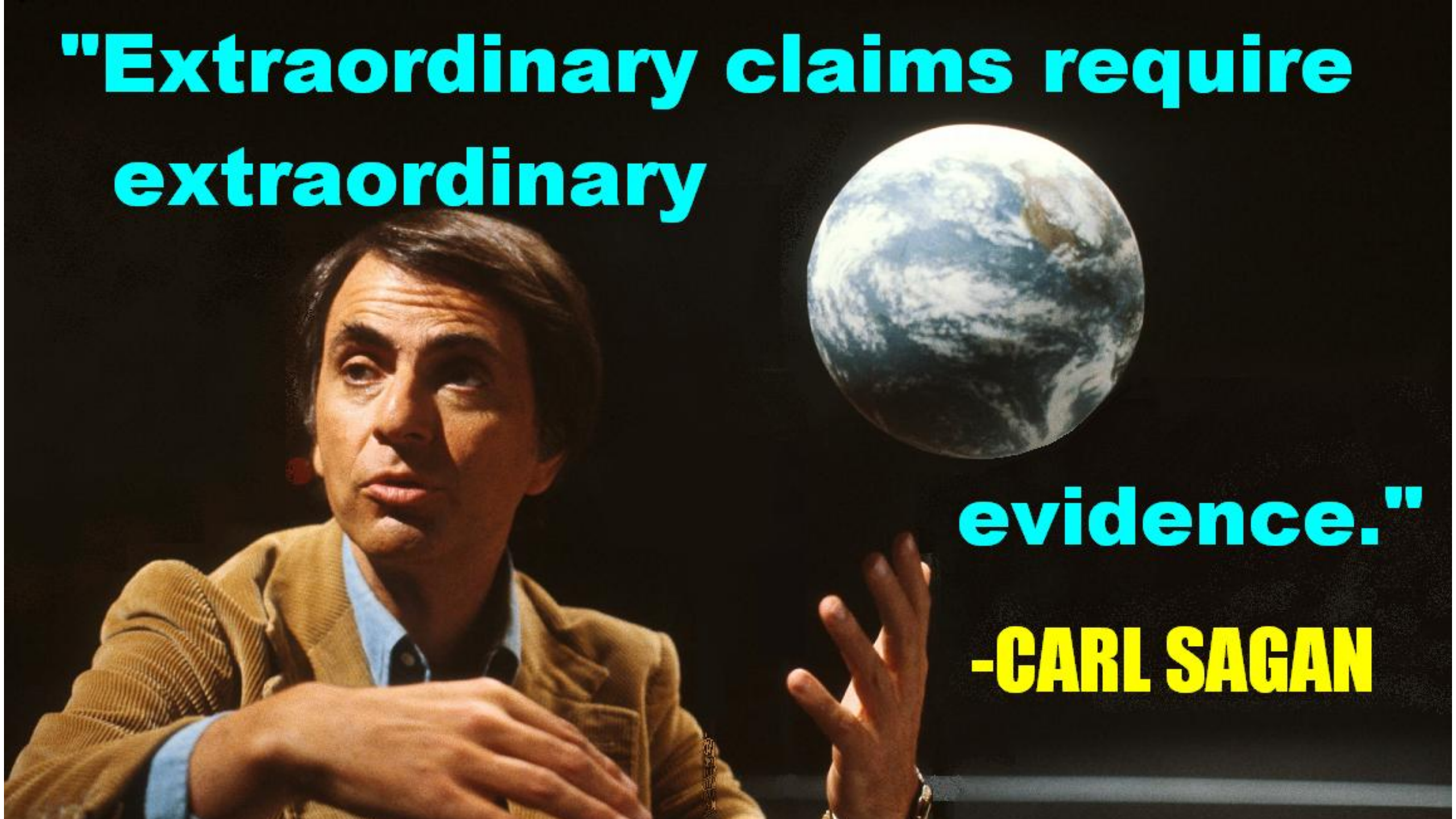
- *Knowing how the cancer rate has soared in the USA over any other country……. (I don't use)…. chemicals……. I won't have to worry about my health being affected by how I keep my home & garden—nor the health of my kids (or someday grandkids), pets, & friends.*

Are cancer rates really increasing in the USA?

- According to the American Cancer Society "Overall, cancer incidence and mortality declined among men; and, although cancer incidence was stable among women, mortality declined."

Cancer rates in some countries are increasing

- The main factor is **because we live longer**
  - UK average age of cancer patient is 60 years old


"Extraordinary claims require extraordinary evidence."
-CARL SAGAN

How glyphosate works in plants

- Disrupts the shikimate acid pathway that leads to the production of aromatic amino acids

- As a result protein development ceases and **plants stop growing** and eventually it dies

Dandelion 3 weeks after application

How glyphosate works in animals

- Different pathway as animals don't have the shikimate acid pathway
  - Only plants and some micoorganisms

- **Unknown**
  - Implicated to be an endocrine disruptor
  - Surfactant in some formulations may be cause of higher toxicity **in animals**.

What do we mean by toxicity?

- Merriam –Webster defines toxicity as:

the quality, state, or relative degree of being poisonous

- Toxicity can vary based on many factors
  - potency of the chemical
  - length and type of exposure
  - type of population
  - individuals (allergic reaction)

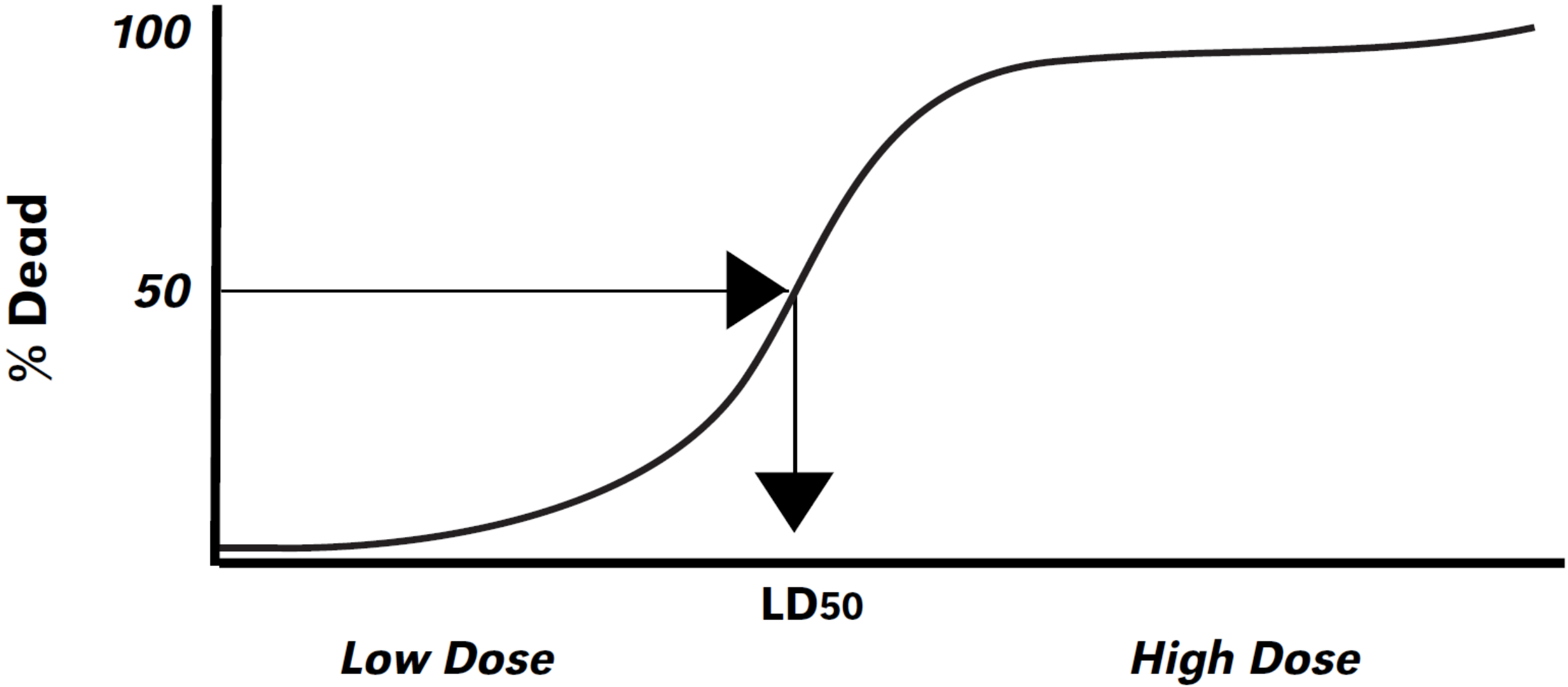
The dose makes the poison

- Toxicity = Concentration substance **x** duration of the exposure.
  - Example: Alcohol: Increases result in predictable increases in alteration of consciousness (signs of inebriation).

- Acute/short-term toxicity = exposed to it and a visible symptom is immediately seen
  - does not reflect any effects from long-term exposure

- Chronic/long-term toxicity = Symptoms appear over longer periods of repeated exposure

A Typical Dose/Response Curve



Follow the arrows to see how the percentage of deaths is used to figure out the LD50 (the dose representing death of 50% of the treated organisms).

What is the acute toxicity of glyphosate to animals?

- Rarely are substances tested on humans, so we rely on animal testing

- **<u>Acute toxicity is considered very low for glyphosate</u>**
  - Oral LD50 (In comparison caffeine LD50 for rats **368 mg/kg**)
    - in rats is > 4,320 mg/kg, in mice >than 10,000 mg/kg and in goats > 3,530 mg/kg
    - in three formulated products ranged from 3,860 to > 5,000 mg/kg in rats.
  - Dermal LD50 (In comparison caffeine LD50 for rats **>2,000 mg/kg**)
    - in rabbits is > 2,000 mg/kg.
  - Inhalation LC50 (In comparison caffeine LD50 for rats **4.94mg/l**)
    - In rats > 4.43 mg/L based on a 4-hour, nose-only inhalation study.21
    - for two formulated products in rats >1.3 mg/L and 3.2 mg/L in rats

What is the acute toxicity of glyphosate to humans?

- **Acute toxicity is considered very low for glyphosate**
- Oral
  - Review of 80 intentional ingestion cases
    - Symptoms: gastrointestinal effects, dysphagia or difficulty swallowing.
    - Seven cases resulted in death (9%)
- Dermal
  - Roundup®, containing 41% glyphosate, was applied to the skin of 204 male and female volunteers. No sensitization was observed.
- Inhalation
  - Inhalation may cause oral/nasal discomfort, throat irritation

What is the chronic toxicity of glyphosate to animals?

- Dogs were fed capsules containing 0, 20,100, or 500 mg/kg/day of glyphosate **for one year**.
  - RESULT: No effects were observed.

- Male rats were fed a diet containing glyphosate at 89, 362, or 940 mg/kg/day and females were similarly fed at concentrations of 113, 457, or 1183 mg/kg/day **for 2 years**.
  - RESULTS:
  - In the high-dose female group, researchers observed decreased body weight gain.
  - In the high-dose male group, researchers observed decreased urinary pH, increased evidence of cataracts and lens abnormalities, and increased liver weight.
  - No effects were observed in the low-dose and mid-dose groups.

- Rats were fed diets containing glyphosate at doses of 0, 100, 300, or 1000 mg/kg/day **for two years**.
  - RESULTS: After 52 weeks, some rats in the two highest dose groups had enlarged salivary glands with cellular changes.

What is the chronic toxicity of glyphosate to humans?

- Collected urine samples over 8 months from workers at two forestry nurseries where glyphosate was used for weed control.
  - RESULTS: **No glyphosate** was detected in any of the 355 urine samples.

- Five forestry workers sprayed glyphosate for 6 hours a day over the course of a week.
  - RESULTS: **No differences** were found in medical examinations and laboratory testing performed on the workers following pesticide application.

- Collected urine samples from farm families in South Carolina and Minnesota
  - RESULTS:
  - On the day of application, 60% of farmers had a detectable level of glyphosate in their urine of at least 1 ppb. (average was 3 ppb with a maximum of 233 ppb)
  - Mean urinary concentrations of glyphosate were higher in farmers **who did not use rubber gloves during application.**

What about cancer?

- **In 2015:** Implicated as potential to cause cancer by IARC (International Agency of Research on Cancer).
  - Specialized cancer agency of the World Health Organization
  - No regulatory function
- Determined to not likely be carcinogenic/cause risk to humans by
  - Environmental Protection Agency (2017)
  - European Food Safety Authority (2015)
  - Joint FAO/WHO Meeting on Pesticide Residues (2016)
    - FAO = United Nations Food and Agriculture organization
    - WHO = World Health Organization

Why the differences in conclusions?

- Different people summarizing the information with different processes
  - IARC: Invited experts
  - EPA/European Union: In house scientists

- Different approaches
  - IARC evaluates if a compound is carcinogenic without considering use patterns
  - Regulatory groups include use patterns

EPA recently released an updated Review of glyphosate (December 2017)

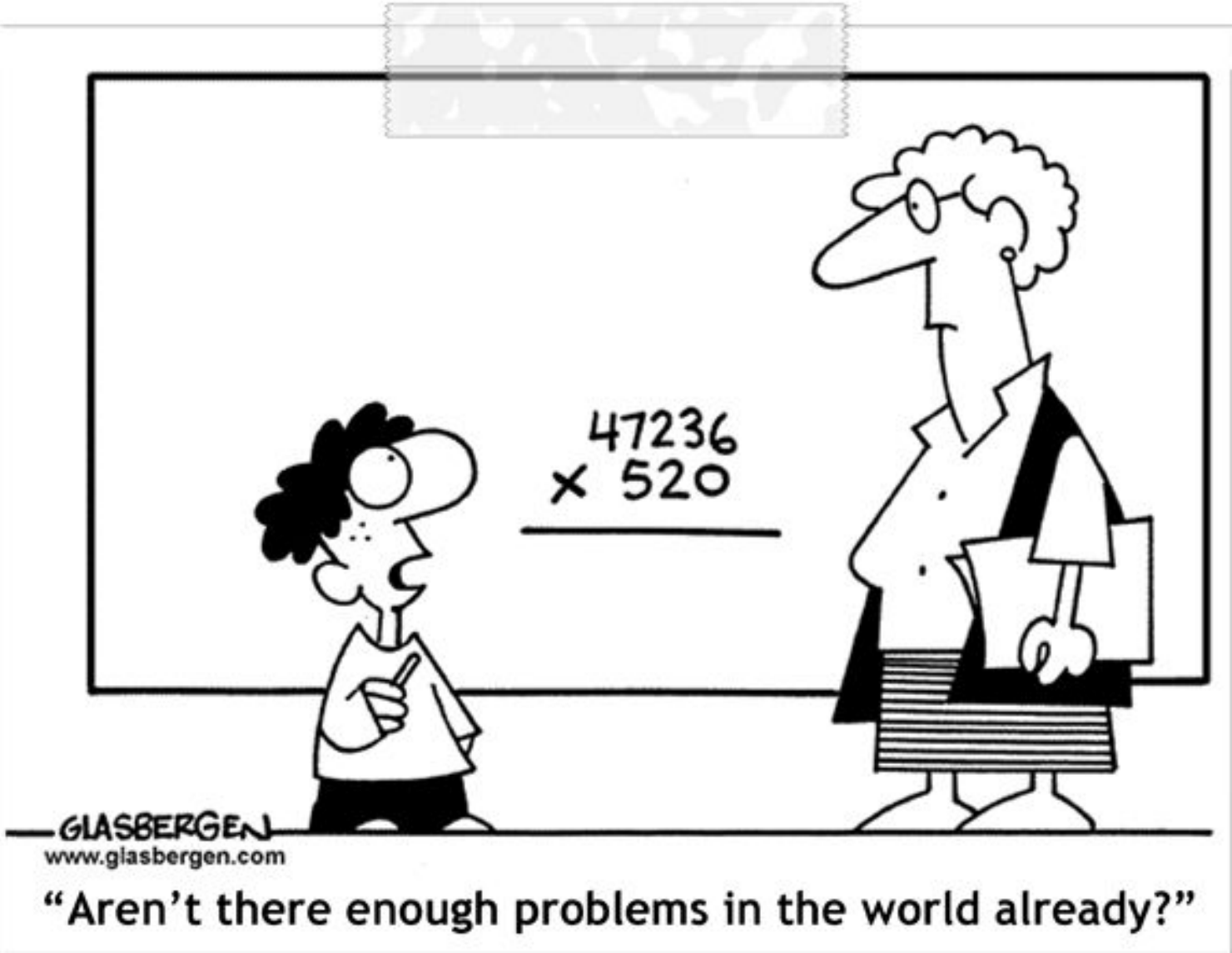
OUT FOR COMMENT

- "Reevaluated the human carcinogenic potential of glyphosate, which included a weight-of-evidence evaluation of data from animal toxicity, genotoxicity, and epidemiological studies……. **The Agency concluded that glyphosate should be classified as "not likely to be carcinogenic to humans."**

  - It should be noted that some of the studies assigned a low quality ranking in the current evaluation were included in the recent evaluation by IARC.
  - In most instances, these studies reported effect estimates for total pesticide exposure and/or assumed glyphosate exposure without collecting glyphosate-specific exposure information.

So groups disagree on the result…..

- How are you supposed to interpret this information??????
- Many groups have agendas…
  - Industry
  - Not for profit
  - Even some scientists….

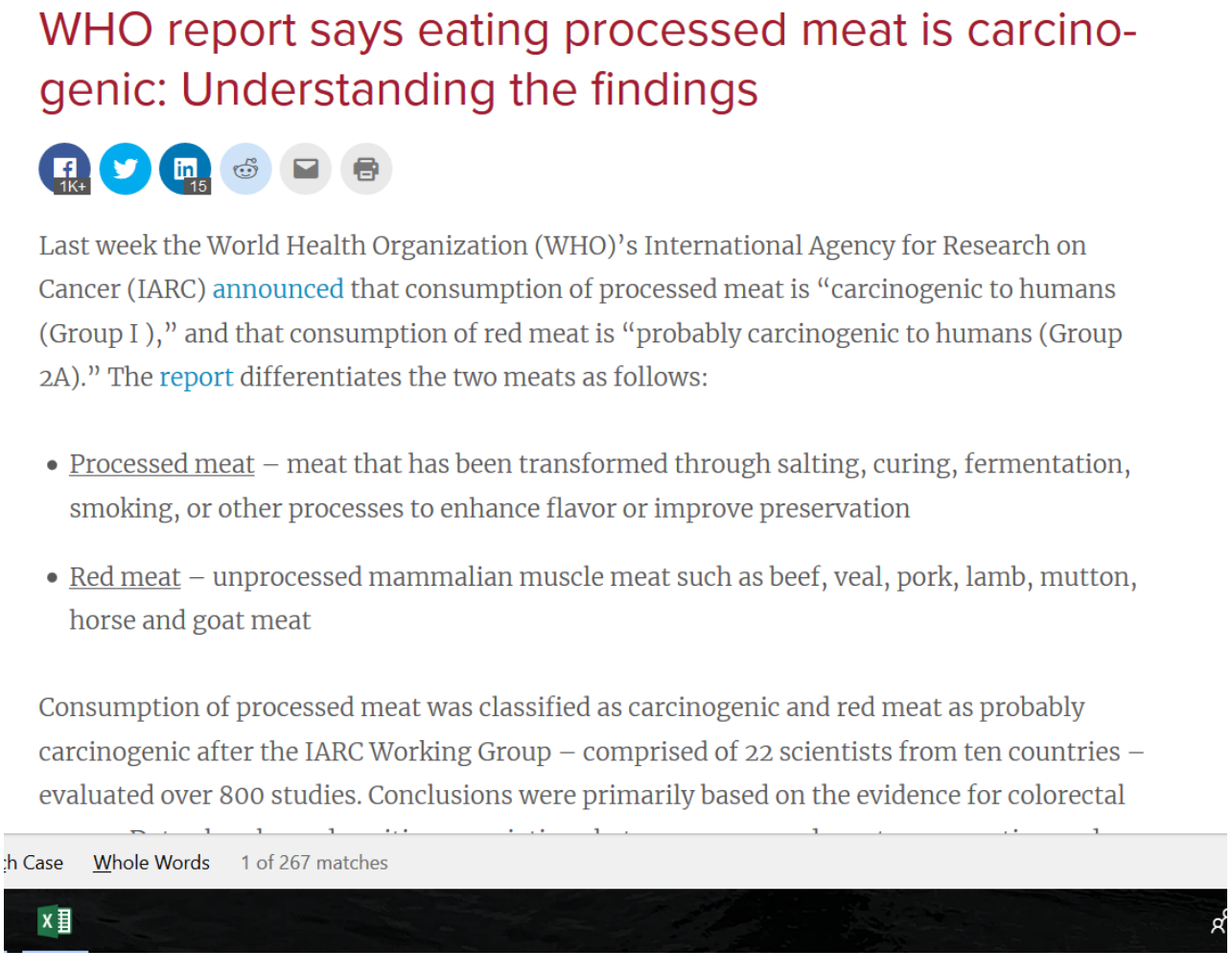


Who is the greatest quarterback in Green Bay Packers history?

Let’s assume that glyphosate is cancer causing/carcinogen. What else is listed?

- IARC LIST of of products **known to be carcinogens**
  - 112 compounds
  - Includes:
    - Alcoholic beverages (ethanol)
    - Diesel engine exhaust
    - **Consumption of processed meats**
    - Solar radiation
    - Tobacco (smoke, first or second hand)
    - Wood dust
- Glyphosate is listed as “probably carcinogenic”

Need to be careful about the details, the media doesn't help….



WHO report says eating processed meat is carcino-genic: Understanding the findings

Last week the World Health Organization (WHO)'s International Agency for Research on Cancer (IARC) announced that consumption of processed meat is "carcinogenic to humans (Group I)," and that consumption of red meat is "probably carcinogenic to humans (Group 2A)." The report differentiates the two meats as follows:

- Processed meat – meat that has been transformed through salting, curing, fermentation, smoking, or other processes to enhance flavor or improve preservation
- Red meat – unprocessed mammalian muscle meat such as beef, veal, pork, lamb, mutton, horse and goat meat

Consumption of processed meat was classified as carcinogenic and red meat as probably carcinogenic after the IARC Working Group – comprised of 22 scientists from ten countries – evaluated over 800 studies. Conclusions were primarily based on the evidence for colorectal

What are the details of the report:

- The amount ingested matters
  - 50 g/day (0.1 lbs)
- Putting the risk into perspective: (American cancer Society)
  - lifetime risk colon cancer is 5%.
  - If eat more than 50g/day processed meat would raise lifetime risk to 6%.
- Size of risk is different for each compound
  - 34,000 deaths per year to high processed meat intake
  - 1 million deaths per year attributable to tobacco smoke.

Coffee and Cancer: What the Research Really Shows

Apr 3, 2018

https://www.cancer.org/latest-news/coffee-and-cancer-what-the-research-really-shows.html

Quote from the American Cancer Society

"…..preventing smoking initiation and improving smoking cessation rates remain the most important ways to reduce cancer mortality rates worldwide. After smoking, we also know that certain healthy lifestyle habits can significantly minimize cancer risk: these include

1. Limiting alcohol consumption
2. Maintaining a healthy body weight throughout adulthood,
3. Being physically active
4. Consuming a mostly plant-based diet.

If you are concerned about acrylamide exposure, you may also consider limiting intake of French fries, chips, and cookies, which is consistent with the American Cancer Society's dietary guidelines.

Roundup Products Liability Litigation (MDL No. 2741) court case

This court case did not introduce any new science into this question about glyphosate toxicity

1. Glyphosate is one of the most studied chemicals in the world
2. Most of the information in the media is over-simplified, but this is really a complicated issue with many nuances

US District Court awarded individual $289 Million for damages in relation to glyphosate/roundup

- The decision was made by a jury not scientists….
- The core issues of the case were
  - **Does glyphosate causes cancer?**
  - Did Monsanto not disclose this added risk to clientele?
  - Did glyphosate exposure cause the plaintiff's cancer?

They used the same information I summarized……

Example of concern about pesticide use and how to communicate it

- Douglas County has passed an ordinance making it illegal to apply pesticides on public lands
- County forests/woodlands are being over-run by invasive shrubs
  - Bush honeysuckle
  - Buckthorn
- Attempting to control with grazing (goats), spending $$$ over three years with limited success.
- We were contacted by county forester to help compare herbicides as an alternative tool

Pesticide use deserves explanation

Douglas County residents need to know their County Forestry Committee is quietly proceeding with a legally questionable herbicide application without adequate public notification. It's scheduled to occur soon in Lucius Woods Park in the village of Solon Springs.

Douglas County has a longstanding pesticide ordinance that prohibits the use of pesticides unless the person requesting the exemption shows that some urgency is involved. Also a form must be filled out showing that all other less harmful options have been tried and will not work.

A University of Wisconsin-Extension staff person proposed and had approved by the Forestry Committee an ordinance pesticide exemption. It appears the form was not filled out properly. The pesticide to be used is glyphosate, which has been declared a probable carcinogen by the World Health Organization. Consequently, California puts that label on all their glyphosate products. Why the Douglas County Forestry Committee would choose a spot where large numbers of people gather to picnic, camp, swim and watch musical performances when other sites remote from human activity were available boggles the logical mind.

Presently, the buckthorn there is being controlled by goats. The herd manager wrote a letter to the County Board, county corporate counsel and the administrative department. She sent a letter to the County Board detailing her concerns and to alert the public to what is going on. She attended the County Board meeting for a discussion, but the County Board refused to have her letter read.

The corporate counsel, the County Board and the county administration have yet to respond to the herd manager's concerns.

Here is contact information for some of the officials who may be interested in answering your questions on this subject: Jane Anklam, UW-Extension, (715) 395-1515; Douglas County Forestry, (715) 378-2219; Mark Liebaert, Douglas County

Developed a plan, and began to implement when people got concerned

- Concern about use of glyphosate
  - Public space
- Thinks it is already being controlled by goats
- Thinks staff are ignoring requests

We were then contacted by the newspaper

- All people involved in the treatments were communicating and on the same page
  - Local UWEX county agent, County staff, My staff
- Gave reporter all the critical information they requested in a timely fashion
  - Were looking for “questionable behavior”
- Offered to have public meetings to answer questions

Then had local meeting to discuss the issue

- Local staff came prepared with information/data to support our efforts
- Applied Garlon 4 (triclopyr) to 15,000 ft2 of the woods.
  - We applied the two treatments (cut surface vs foliar) to individual plants.
  - used 3.9 fl oz across both areas (small amount).
- estimate cost for application : $76/A for the foliar and $91/A for cut surface.
  - Compare to the $2,000 per acre cost (annually for grazing)
- Currently measuring impact of methods on target and non-target species

The best thing we did was inform our applicators/field staff about the potential issue

- Had discussion with locals about the treatment.
- Prepared them with the background info and resources/contact info.
- People had questions, and when they got the facts they were not concerned
  - Used only <5 mL in the entire forest….
  - Couldn’t see any large impact as we spot treated
  - Focused on protecting resources (controlling invasive vs killing things)

In summary, be prepared to communicate!

Where can I find information about pesticides

- Simple info for public consumption
  - National pesticide information center (http://npic.orst.edu/)

- Environmental Protection Agency https://www.epa.gov/
  - Good info on overview of risk assessment of pesticides in the US
  - Information on what data is collected and access to collected info
    - Search: Test Guidelines for Pesticides and Toxic Substances
    - Search by active ingredient
      - Look at re-registration material
- Federal Registry https://www.federalregister.gov/
  - Search by active ingredient

Realize that much of the information is created by companies that are trying to register products

- EPA does this as it can take > $100 million dollars to register
  - Makes registrants
    - Conduct studies and submit data to support registration
    - pay money to receive a label (annually)

- EPA closely monitors results to ensure accuracy
  - Some people question the accuracy of data….

In Summary

- Glyphosate is a herbicide that has low **acute** human toxicology
- It is debated if glyphosate can cause cancer, but current research suggests that **IF it is a carcinogen**, it is much less potent that other items we voluntarily ingest …
  - Processed meat, alcohol
- If using glyphosate or other pesticide products, consult expert information/resources and develop a clear guideline so you can communicate your process
  - Not communicating information has led to much of the problem…

Other Opinions?