

# PESTICIDE RESEARCH UPDATES

2018

KACI BUHL, ASSOCIATE PROFESSOR OF PRACTICE

OREGON STATE UNIVERSITY

**Oregon State**  
UNIVERSITY

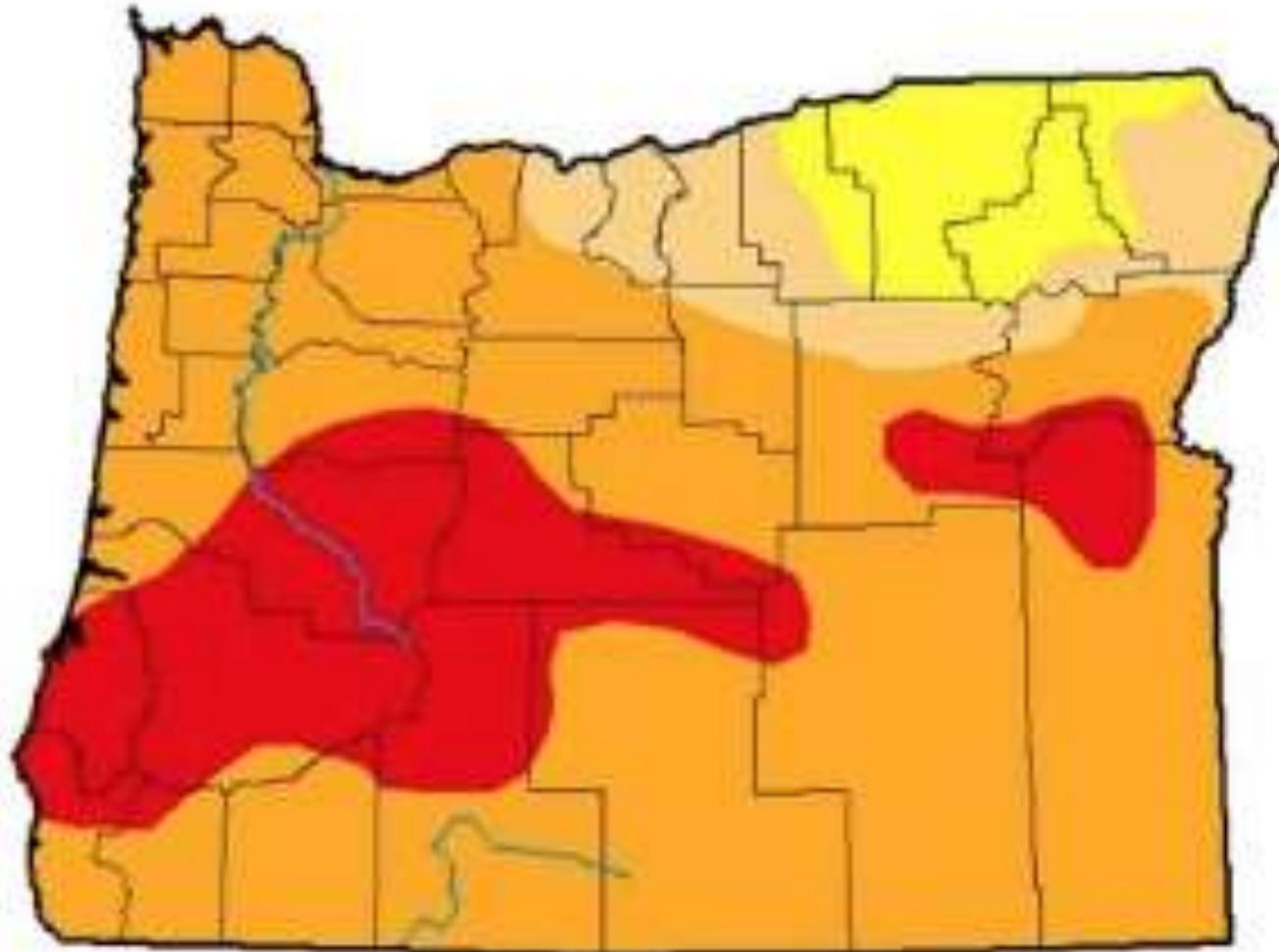
# QUESTIONS?

- WHAT HAVE YOU HEARD IN THE HEADLINES? ARE THERE NEW STUDIES THAT RAISE CONCERNS?
- DO YOU HAVE QUESTIONS? HAS YOUR CREW HAD QUESTIONS? HAS THE PUBLIC HAD QUESTIONS?
  
- HAVE HEADLINES OR QUESTIONS HAD AN IMPACT ON YOUR PROGRAM?
- HOW DID YOU RESPOND?
- HAS /WILL YOUR PROGRAM CHANGE IN RESPONSE?

A scenic view of a rocky coastline. In the foreground, there is a body of water with a few small dark spots. The middle ground shows a rocky shoreline with several large, dark rock formations. The background is a steep, forested hillside with a mix of green and brown tones, suggesting a natural, rugged environment.

**Drought conditions are serious or  
*extreme* in Oregon**

“Like spring, even if we got some rain this winter, we’re going to see some trees dying,” Shaw says.



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	93.05	83.81	21.58	0.00
Last Week 09-29-2018	0.00	100.00	93.05	79.13	6.18	0.00
3 Months Ago 07-05-2018	9.50	90.50	45.30	18.36	0.00	0.00
Start of Calendar Year 01-01-2018	100.00	0.00	0.00	0.00	0.00	0.00
Start of Water Year 09-26-2017	39.23	60.77	28.57	0.00	0.00	0.00
One Year Ago 09-03-2017	22.33	77.67	13.50	0.00	0.00	0.00

Intensity

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author

David Miskus  
NOAA/NWS/NCEP/CPC

## Forest Service to cut hundreds of ponderosa pines near Sisters killed by herbicide

ODOT, Forest Service planning dead tree removal near U.S. Highway 20



**STEPHEN HAMWAY**

THE BULLETIN

Twitter @Shamway1

[View stories and bio](#)



# Oregon Bans Tree-Killing Herbicide Amid Sweeping Investigation

by Emily Cureton [Follow](#) OPB Oct. 1, 2018 12:17 p.m. | Updated: Oct. 1, 2018 1:48 p.m.

The herbicide is called aminocyclopyrachlor.

In Central Oregon, she said trees were poisoned in at least four locations. ODA has prohibited the use of products with aminocyclopyrachlor until April, and lasting regulation could be established.

The label for Perspective has long included a warning about tree exposure, and a list of species vulnerable to small amounts of the herbicide, including Ponderosa pines.

# Jurors give \$289 million to a man they say got cancer from Monsanto's Roundup weedkiller



By **Holly Yan**, CNN

🕒 Updated 9:28 PM ET, Sat August 11, 2018



Judge reads final verdict in Monsanto case 01:32

## More from CNN



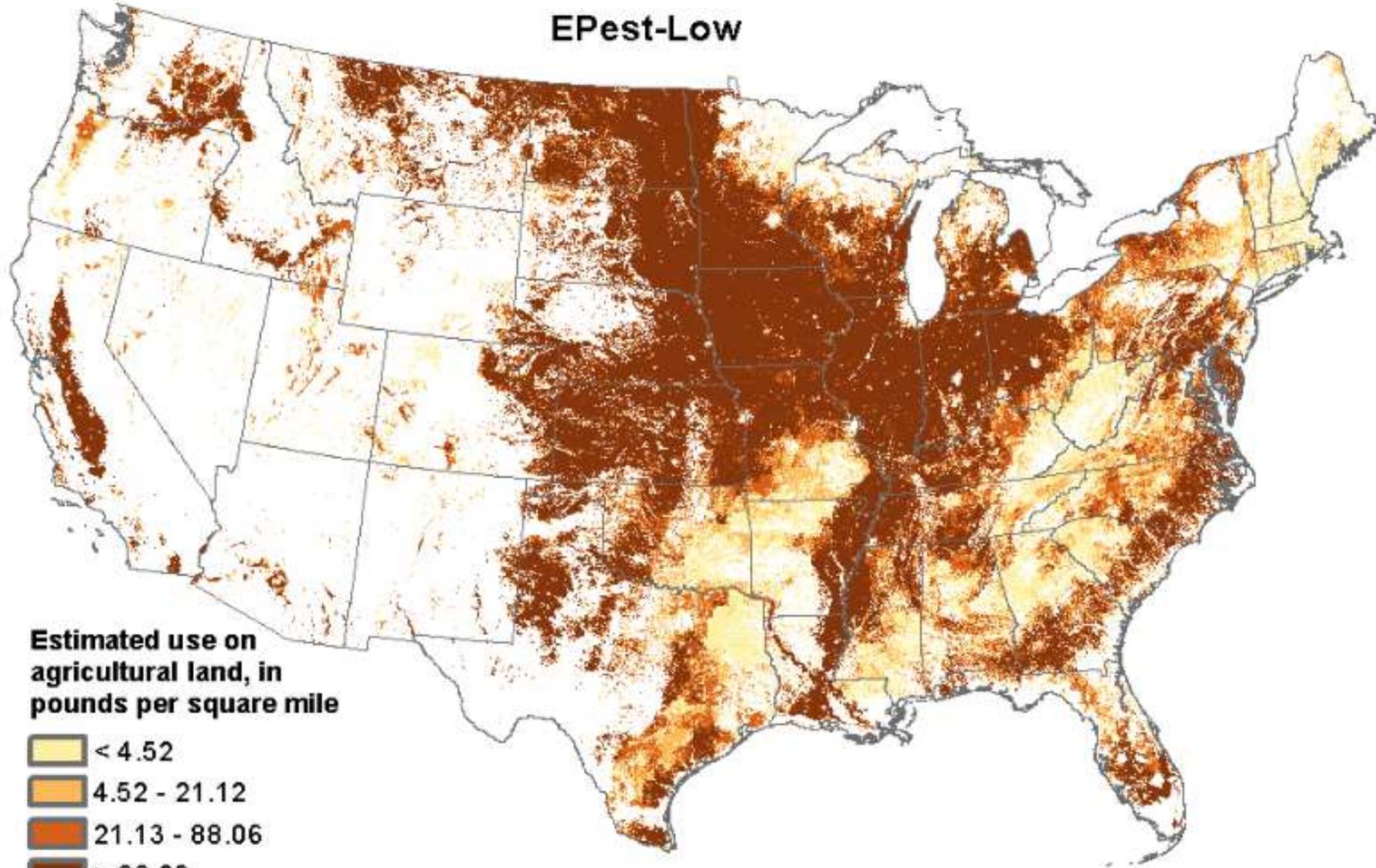
Reality star Lyric McHenry dies at 26



Camping for the first time in Airstream's tiny new luxury trailer

# Estimated Agricultural Use for Glyphosate , 2015 (Preliminary)

## EPest-Low



**Estimated use on  
agricultural land, in  
pounds per square mile**

 < 4.52

 4.52 - 21.12

 21.13 - 88.06

 > 88.06

 No estimated use

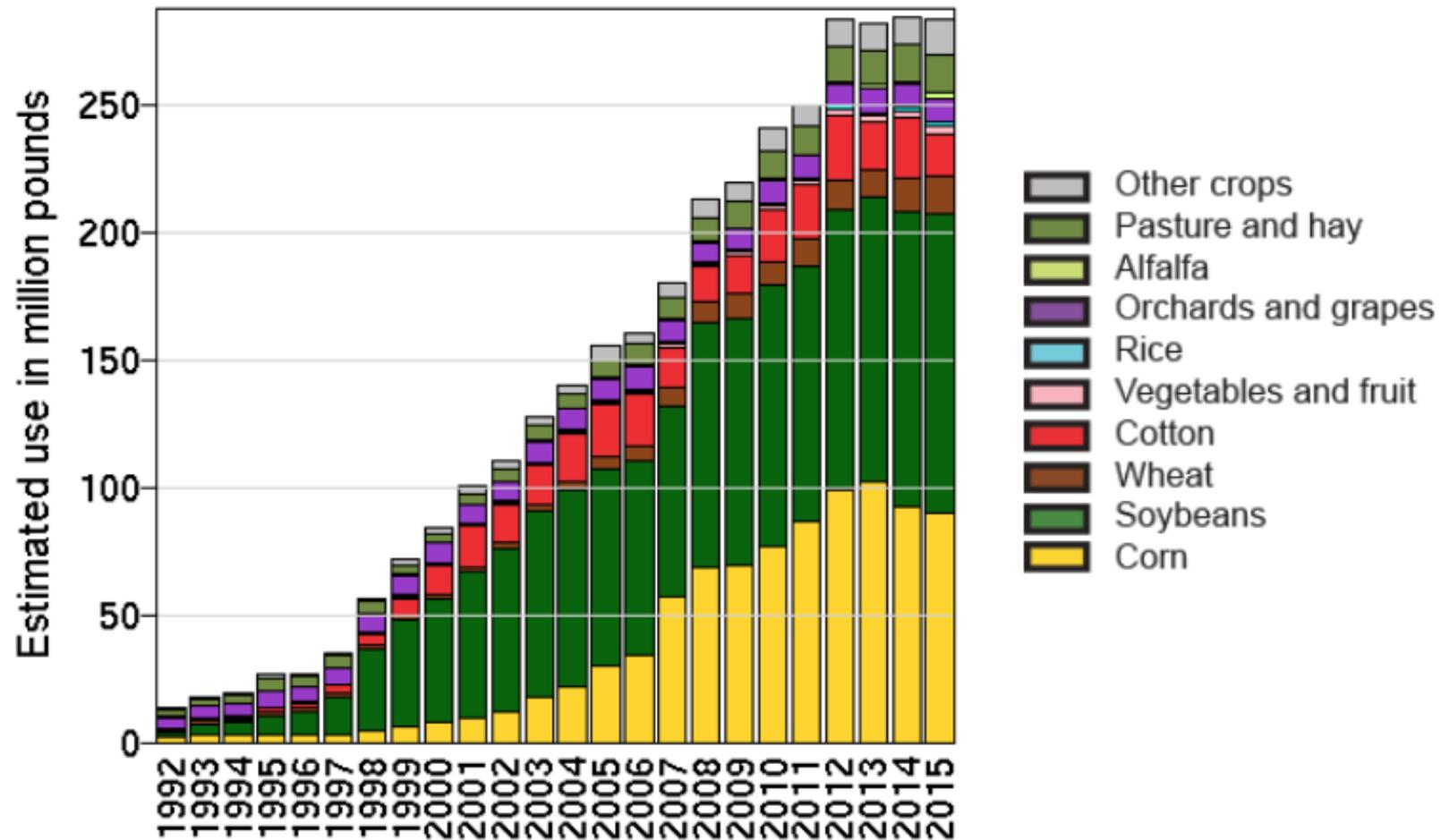
[U.S. Department of the Interior | U.S. Geological Survey](http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map)

URL: [http://water.usgs.gov/nawqa/pnsp/usage/maps/show\\_map](http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map).

Page Contact Information: [gs-w\\_nawqa\\_whq@usgs.gov](mailto:gs-w_nawqa_whq@usgs.gov)

Page Last Modified: January 17 2017 09:55:22.

# Use by Year and Crop



[U.S. Department of the Interior](#) | [U.S. Geological Survey](#)

URL: [http://water.usgs.gov/nawqa/pnsp/usage/maps/show\\_map.php?year=2012](http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=2012)

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Page Last Modified: March 18 2015 13:44:16.

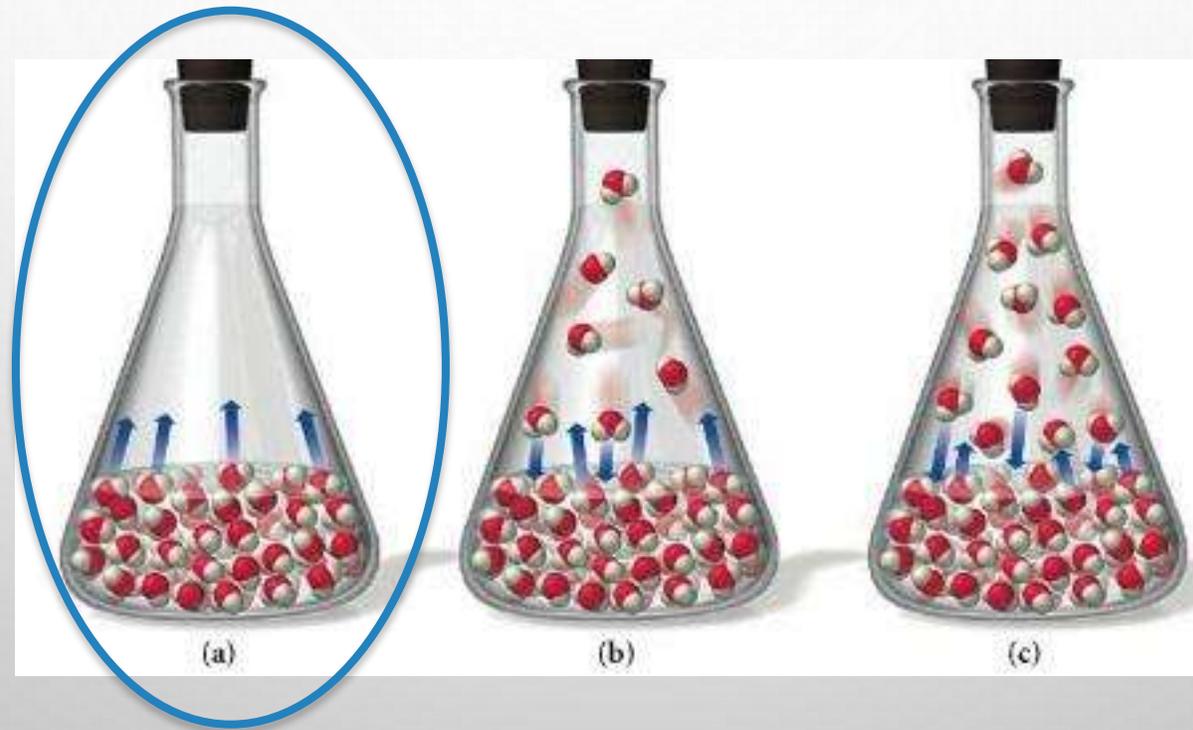
Glyphosate sticks to soil strongly.



Many products registered for application to aquatic areas.

Does glyphosate become vaporous?

No.



## TOXICITY CLASSIFICATION - GLYPHOSATE

	High Toxicity	Moderate Toxicity	Low Toxicity	Very Low Toxicity
<b>Acute Oral LD<sub>50</sub></b>	Up to and including 50 mg/kg (≤ 50 mg/kg)	Greater than 50 through 500 mg/kg (>50-500 mg/kg)	<b>Greater than 500 through 5000 mg/kg (&gt;500-5000 mg/kg)</b>	<b>Greater than 5000 mg/kg (&gt;5000 mg/kg)</b>
<b>Inhalation LC<sub>50</sub></b>	Up to and including 0.05 mg/L (≤0.05 mg/L)	Greater than 0.05 through 0.5 mg/L (>0.05-0.5 mg/L)	<b>Greater than 0.5 through 2.0 mg/L (&gt;0.5-2.0 mg/L)</b>	<b>Greater than 2.0 mg/L (&gt;2.0 mg/L)</b>
<b>Dermal LD<sub>50</sub></b>	Up to and including 200 mg/kg (≤200 mg/kg)	Greater than 200 through 2000 mg/kg (>200-2000 mg/kg)	<b>Greater than 2000 through 5000 mg/kg (&gt;2000-5000 mg/kg)</b>	Greater than 5000 mg/kg (>5000 mg/kg)
<b>Primary Eye Irritation</b>	Corrosive (irreversible destruction of ocular tissue) or corneal involvement or irritation persisting for more than 21 days	Corneal involvement or other eye irritation clearing in 8 - 21 days	<b>Corneal involvement or other eye irritation clearing in 7 days or less</b>	<b>Minimal effects clearing in less than 24 hours</b>
<b>Primary Skin Irritation</b>	Corrosive (tissue destruction into the dermis and/or scarring)	Severe irritation at 72 hours (severe erythema or edema)	Moderate irritation at 72 hours (moderate erythema)	<b>Mild or slight irritation at 72 hours (no irritation or erythema)</b>

**The highlighted boxes reflect the values in the "Acute Toxicity" section of this fact sheet.** Modeled after the U.S. Environmental Protection Agency, Office of Pesticide Programs, Label Review Manual, Chapter 7: Precautionary Labeling. <http://www.epa.gov/oppfead1/labeling/lrm/chap-07.pdf>

- When swallowed, about 1/3 of glyphosate is absorbed.
- About 2% of glyphosate is absorbed through skin.



# Cancer

- Animal studies have mixed results, but mostly negative.
- Epidemiological data show a suggested association with Non-Hodgkins Lymphoma (NHL).
- EPA classification: “Evidence of non-carcinogenicity”
- IARC classification: “Probable carcinogen”

IARC-International Agency for Research on Cancer-reviews published studies, IDs POTENTIAL CANCER HAZARD

WHO-World Health Organization-Assesses health risk from dietary exposure to pesticide residue in food.



## “Odds Ratios”

4 cancers in the population  
WITH exposure

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4 cancers in the population  
with NO exposure

$$4/4 = 1$$

5 cancers in the population  
WITH exposure

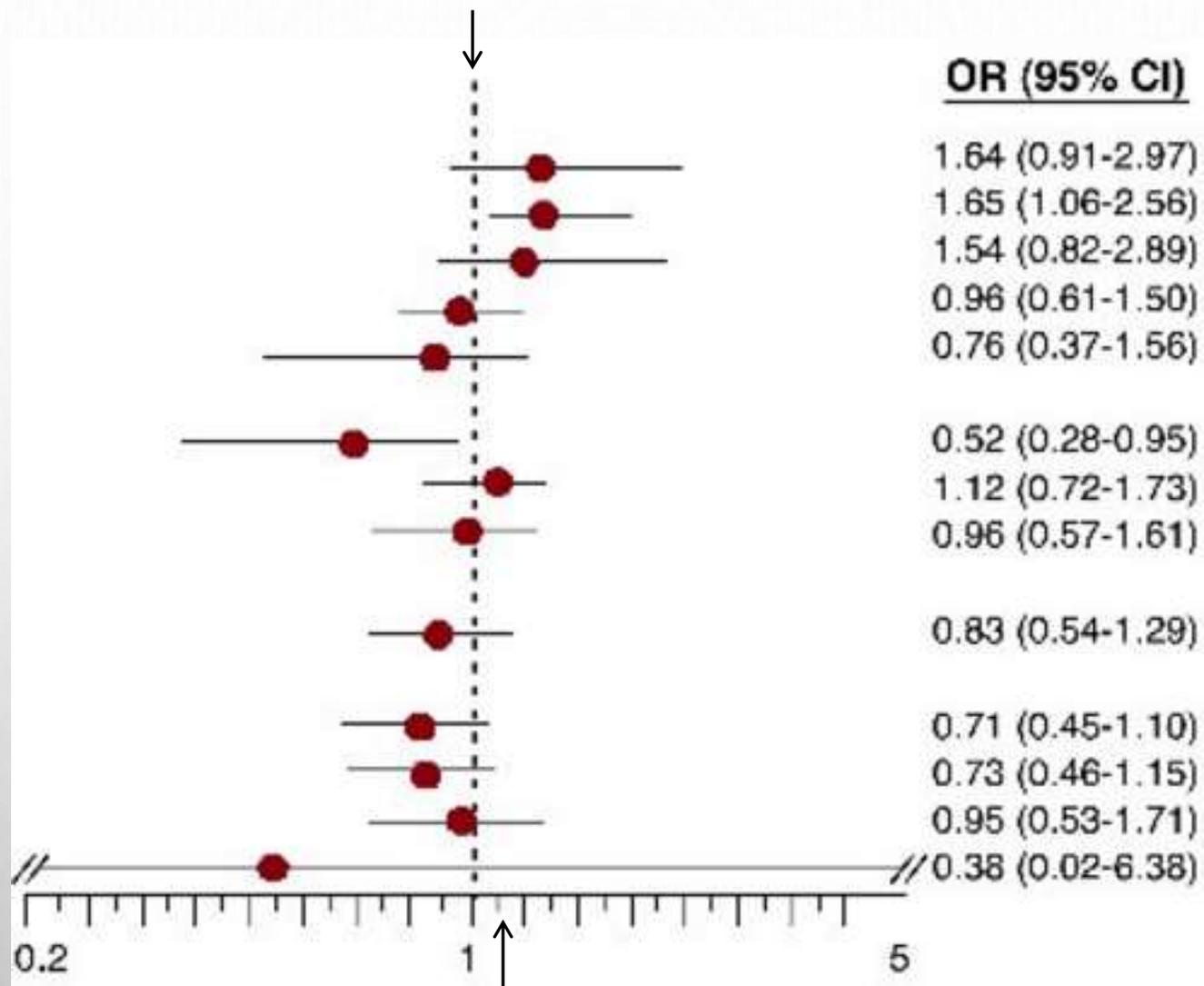
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4 cancers in the population  
with NO exposure

$$5/4 = 1.25$$

*25% higher risk of  
cancer with exposure*

$$4/4 = 1$$



$$5/4 = 1.25$$

**Table 2.2 Case-control studies of leukaemia and lymphoma and exposure to glyphosate**

Reference, location, enrolment period	Population size, description, exposure assessment method	Organ site (ICD code)	Exposure category or level	Exposed cases/deaths	Risk estimate (95% CI)	Covariates controlled
USA						
<a href="#">Brown et al. (1990)</a> Iowa and Minnesota, USA 1981-1983	Cases: 578 (340 living, 238 deceased) (response rate, 86%); cancer registry or hospital records Controls: 1245 (820 living, 425 deceased) (response rate, 77-79%); random-digit dialling for those aged < 65 years and Medicare for those aged ≥ 65 years Exposure assessment method: questionnaire	Leukaemia	Any glyphosate	15	0.9 (0.5-1.6)	Age, vital status, state, tobacco use, family history lymphopoietic cancer, high-risk occupations, high risk exposures
<a href="#">Cantor et al. (1992)</a> Iowa and Minnesota, USA 1980-1982	Cases: 622 (response rate, 89.0%); Iowa health registry records and Minnesota hospital and pathology records Controls: 1245 (response rate, 76-79%); population-based; no cancer of the lymphohaematopoietic system; frequency-matched to cases by age (5-year group), vital status, state. Random-digit dialling (aged < 65 years); Medicare records (aged ≥ 65 years); state death certificate files (deceased subjects) Exposure assessment method: questionnaire; in-person interview	NHL	Ever handled glyphosate	26	1.1 (0.7-1.9)	Age, vital status, state, smoking status, family history lymphopoietic cancer, high-risk occupations, high-risk exposures

(0.7 - 1.9)



**Table 2.2 (continued)**

Reference, location, enrolment period	Population size, description, exposure assessment method	Organ site (ICD code)	Exposure category or level	Exposed cases/deaths	Risk estimate (95% CI)	Covariates controlled
<a href="#">Brown et al. (1993)</a> Iowa, USA 1981–1984	Cases: 173 (response rate, 84%); Iowa health registry Controls: 650 (response rate, 78%); Random-digit dialling (aged < 65 years) and Medicare (aged > 65 years) Exposure assessment method: questionnaire	Multiple myeloma	Any glyphosate	11	1.7 (0.8–3.6)	Age, vital status
<a href="#">De Roos et al. (2003)</a> Nebraska, Iowa, Minnesota, Kansas, USA 1979–1986	Cases: 650 (response rate, 74.7%); cancer registries and hospital records Controls: 1933 (response rate, 75.2%); random-digit dialling, Medicare, state mortality files Exposure assessment method: questionnaire; interview (direct or next-of-kin)	NHL	Any glyphosate exposure	36	2.1 (1.1–4)	Age, study area, other pesticides

 (1.1 – 4)

**Table 2.2 (continued)**

Reference, location, enrolment period	Population size, description, exposure assessment method	Organ site (ICD code)	Exposure category or level	Exposed cases/deaths	Risk estimate (95% CI)	Covariates controlled
<a href="#">Lee et al. (2004a)</a> Iowa, Minnesota and Nebraska, USA 1980–1986	Cases: 872 (response rate, NR); diagnosed with NHL from 1980 to 1986 Controls: 2381 (response rate, NR); frequency-matched controls Exposure assessment method: questionnaire; information on use of pesticides and history of asthma was based on interviews	NHL	Exposed to glyphosate – non-asthmatics	53	1.4 (0.98–2.1)	Age, vital status,
				 (0.98 – 2.1)		
			Exposed to glyphosate – asthmatics	6	1.2 (0.4–3.3)	
				 (0.4 – 3.3)		
<i>Canada</i>						
<a href="#">McDuffie et al. (2001)</a> Canada 1991–1994	Cases: 517 (response rate, 67.1%), from cancer registries and hospitals Controls: 1506 (response rate, 48%); random sample from health insurance and voting records Exposure assessment method: questionnaire, some administered by telephone, some by post	NHL	Exposed to glyphosate	51	1.2 (0.83–1.74)	Age, province of residence
				 (0.83 – 1.74)		
			Unexposed > 0 and ≤ 2 days	464	1	
			> 2 days	28	1.0 (0.63–1.57)	
				23	2.12 (1.2–3.73)	
					 (1.2 – 3.73)	

**Table 2.2 (continued)**

Reference, location, enrolment period	Population size, description, exposure assessment method	Organ site (ICD code)	Exposure category or level	Exposed cases/deaths	Risk estimate (95% CI)	Covariates controlled
<a href="#">Hardell &amp; Eriksson (1999)</a> Northern and middle Sweden 1987–1990	Cases: 404 (192 deceased) (response rate, 91%); regional cancer registries Controls: 741 (response rate, 84%); live controls matched for age and county were recruited from the national population registry, and deceased cases matched for age and year of death were identified from the national registry for causes of death Exposure assessment method: questionnaire	NHL (ICD-9 200 and 202)	Ever glyphosate – univariate	4	2.3 (0.4–13)	Not specified in the multivariable analysis
			Ever glyphosate multivariate	NR	5.8 (0.6–54)	
<a href="#">Hardell et al. (2002)</a> Sweden; four Northern counties and three counties in mid Sweden 1987–1992	Cases: 515 (response rate, 91% in both studies); Swedish cancer registry Controls: 1141 (response rates, 84% and 83%); national population registry Exposure assessment method: questionnaire	NHL and HCL	Ever glyphosate exposure (univariate)	8	3.04 (1.08–8.5)	Age, county, study site, sex, education, smoking, alcohol intake
			Ever glyphosate exposure (multivariate)	8	1.85 (0.55–6.2)	



(0.6 – 54)



(1.08 – 8.5)



(0.55 – 6.2)

Table 2.2 (continued)

Reference, location, enrolment period	Population size, description, exposure assessment method	Organ site (ICD code)	Exposure category or level	Exposed cases/ deaths	Risk estimate (95% CI)	Covariates controlled		
<a href="#">Eriksson et al. (2008)</a> Sweden. Four health service areas (Lund, Linköping, Örebro and Umeå) 1999–2002	Cases: 910 (response rate, 91%); incident NHL cases were enrolled from university hospitals Controls: 1016 (response rate, 92%); national population registry Exposure assessment method: questionnaire	NHL	Any glyphosate	29	2.02 (1.1–3.71)	 (1.1 – 3.71)		
			Any glyphosate*	29	1.51 (0.77–2.94)	 (0.77 – 2.94)		
			≤ 10 days per year use	12	1.69 (0.7–4.07)			
				NHL	> 10 days per year use	17	2.36 (1.0–5.37)	 (0.24 – 5.08)
			1–10 yrs		NR	1.11 (0.2–5.08)		
			> 10 yrs		NR	2.26 (1.16–4.4)		
				B-cell lymphoma	Exposure to glyphosate	NR	1.87 (0.99–3.51)	 (1.16 – 4.4)
				Lymphocytic lymphoma/B-CLL	Exposure to glyphosate	NR	3.35 (1.42–7.89)	
				Diffuse large B-cell lymphoma	Exposure to glyphosate	NR	1.22 (0.44–3.35)	
				Follicular, grade I–III	Exposure to glyphosate	NR	1.89 (0.62–5.79)	
				Other specified B-cell lymphoma	Exposure to glyphosate	NR	1.63 (0.53–4.96)	
				Unspecified B-cell lymphoma	Exposure to glyphosate	NR	1.47 (0.33–6.61)	
		T-cell lymphoma	Exposure to glyphosate	NR	2.29 (0.51–10.4)			
		Unspecified NHL	Exposure to glyphosate	NR	1.44 (0.4–2.2)	  (1.44 – 2.2)		

## 6.1 Cancer in humans

There is *limited evidence* in humans for the carcinogenicity of glyphosate. A positive association has been observed for non-Hodgkin lymphoma.

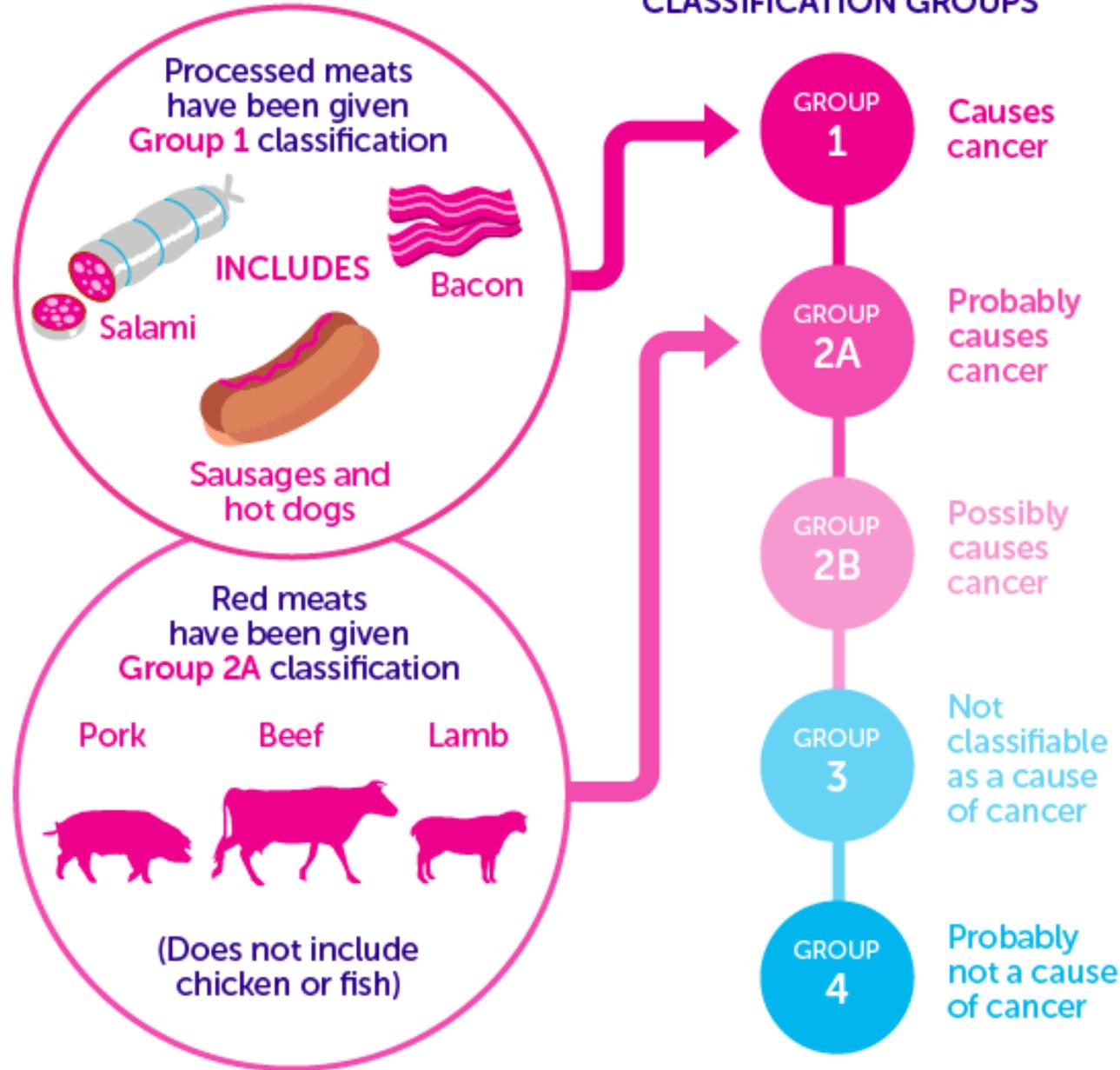
## 6.2 Cancer in experimental animals

There is *sufficient evidence* in experimental animals for the carcinogenicity of glyphosate.

## 6.3 Overall evaluation

Glyphosate is *probably carcinogenic to humans (Group 2A)*.

# IARC CARCINOGENIC CLASSIFICATION GROUPS



glyphosate

2,4-D

These categories represent how likely something is to cause cancer in humans, not how many cancers it causes.



Causes accidents

Probably causes accidents

Possibly causes accidents

Not classifiable

Probably doesn't cause accidents



## International Agency for Research on Cancer



Can it cause cancer?



United States Environmental Protection Agency

Can it cause  
cancer?

+

What level of  
exposure is  
expected?

=

Is that  
exposure level  
likely to result  
in cancer?

# EPA Releases Draft Risk Assessments for Glyphosate

For Release: December 18, 2017

## **CONCLUSIONS:**

The draft human health risk assessment concludes that glyphosate is not likely to be carcinogenic to humans.

humans. The Agency's assessment found no other meaningful risks to human health when the product is used according to the pesticide label. The Agency's scientific findings are consistent with the conclusions of science reviews by a number of other countries as well as the [2017 National Institute of Health Agricultural Health Survey](#).

# Food Safety News

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## EFSA Finds Glyphosate 'Unlikely to Cause Cancer in Humans'

BY DAN FLYNN | NOVEMBER 13, 2015

Europe's gardeners and farmers probably won't have their Monsanto Roundup weed killer or other similar herbicides taken away from them now that the influential European Food Safety Authority (EFSA) has found that the ingredient glyphosate is unlikely to cause cancer in humans.

Glyphosate, which has been around since the 1970s, is used in herbicides around the world, including Monsanto's popular Roundup.

EFSA's [research findings](#) appear to trump the [conclusion](#) this past March by the International Agency for Research on Cancer (IARC), which listed glyphosate as "probably carcinogenic to humans."

EFSA's assessment will be used by the European Commission in deciding whether to keep glyphosate on the EU list of approved active substances. Currently, glyphosate is widely used in both Roundup and in generic brands of herbicides for home gardening and agriculture.





# Cancer agency left in the dark over glyphosate evidence

The World Health Organization's cancer agency says a common weedkiller is "probably carcinogenic." The scientist leading that review knew of fresh data showing no cancer link - but he never mentioned it and the agency did not take it into account.

By [KATE KELLAND](#) | Filed June 14, 2017, 1:05 p.m. GMT



SENIOR SCIENTIST: Aaron Blair, a retired epidemiologist, led the review of several pesticides, including glyphosate, by the International Agency for Research on Cancer in 2015. CREDIT: National Cancer Institute/Bill Branson/Handout via Reuters

Yet if the IARC panel experts had been in a position to take into account Blair's fresh data, IARC's analysis of the evidence on glyphosate would have been different, Blair acknowledged in the court documents reviewed by Reuters.

<http://www.reuters.com/investigates/special-report/glyphosate-cancer-data/>

Format: Abstract ▾

Send to ▾

[J Natl Cancer Inst.](#) 2017 Nov 9. doi: 10.1093/jnci/djx233. [Epub ahead of print]

### **Glyphosate Use and Cancer Incidence in the Agricultural Health Study.**

[Andreotti G](#)<sup>1</sup>, [Koutros S](#)<sup>1</sup>, [Hofmann JN](#)<sup>1</sup>, [Sandler DP](#)<sup>1</sup>, [Lubin JH](#)<sup>1</sup>, [Lynch CF](#)<sup>1</sup>, [Lerro CC](#)<sup>1</sup>, [De Roos AJ](#)<sup>1</sup>, [Parks CG](#)<sup>1</sup>, [Alavanja MC](#)<sup>1</sup>, [Silverman DT](#)<sup>1</sup>, [Beane Freeman LE](#)<sup>1</sup>.

## **CONCLUSIONS:**

In this large, prospective cohort study, no association was apparent between glyphosate and any solid tumors or lymphoid malignancies overall, including NHL and its subtypes.

**RESULTS:** Among 54 251 applicators, 44 932 (82.8%) used glyphosate, including 5779 incident cancer cases (79.3% of all cases). In unlagged analyses, glyphosate was not statistically significantly associated with cancer at any site. However, among applicators in the highest exposure quartile, there was an increased risk of acute myeloid leukemia (AML) compared with never users (RR = 2.44, 95% CI = 0.94 to 6.32, Ptrend = .11), though this association was not statistically significant. Results for AML were similar with a five-year (RRQuartile 4 = 2.32, 95% CI = 0.98 to 5.51, Ptrend = .07) and 20-year exposure lag (RRTerile 3 = 2.04, 95% CI = 1.05 to 3.97, Ptrend = .04).

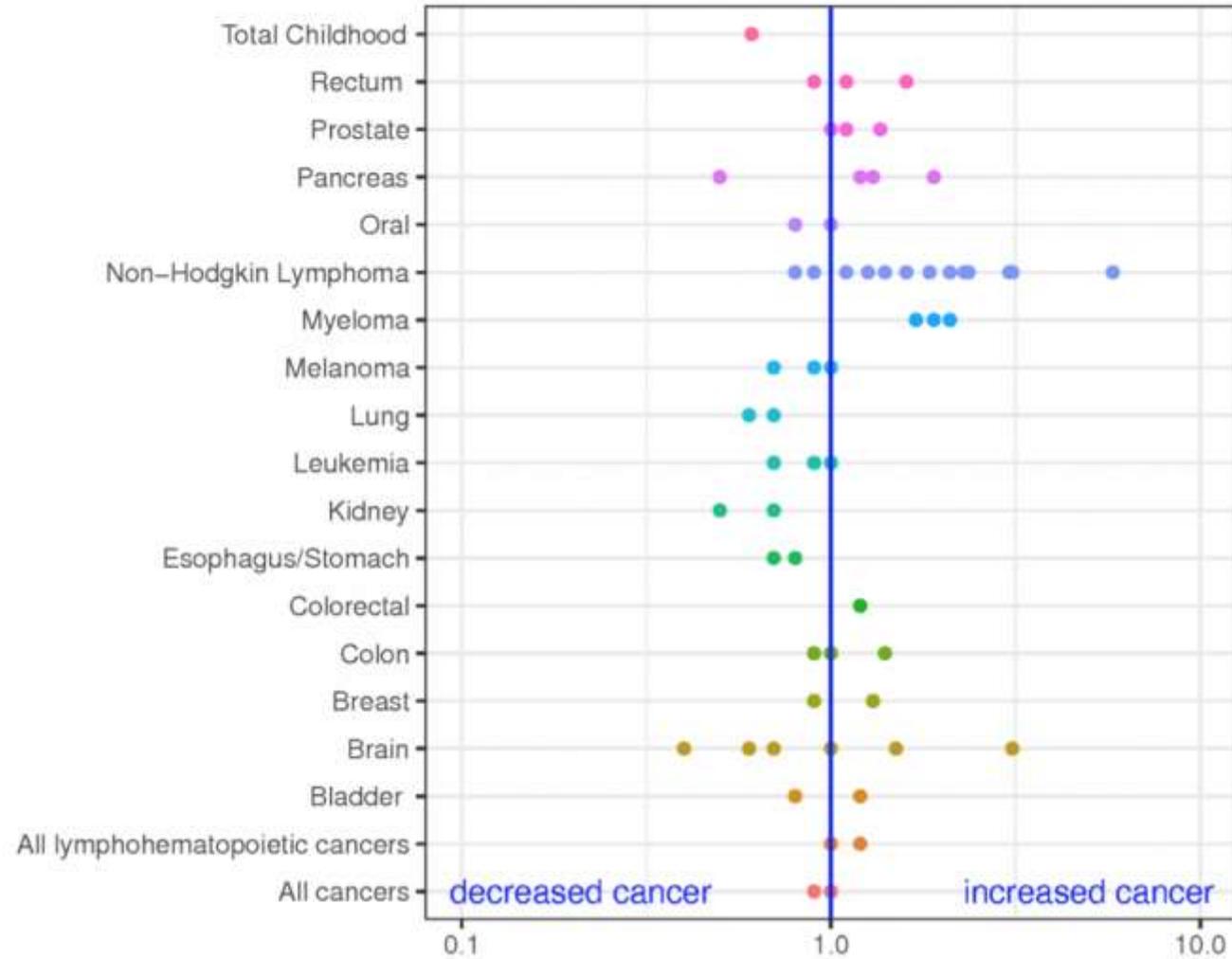
**CONCLUSIONS:** In this large, prospective cohort study, no association was apparent between glyphosate and any solid tumors or lymphoid malignancies overall, including NHL and its subtypes. There was some evidence of increased risk of AML among the highest exposed group that requires confirmation.

## RECENTLY IN EUROPE

- THE EU VOTED IN NOVEMBER, 2017 TO EXTEND REGISTRATION FOR GLYPHOSATE UNTIL 2022 (INSTEAD OF THE TYPICAL 15-YEAR RE-REGISTRATION)
- IN A TWEET AFTER THE VOTE, FRENCH PRESIDENT SAID HE WILL ORDER A BAN ON THE USE OF GLYPHOSATE IN FRANCE "AS SOON AS ALTERNATIVES ARE FOUND, AND WITHIN THREE YEARS AT THE LATEST"



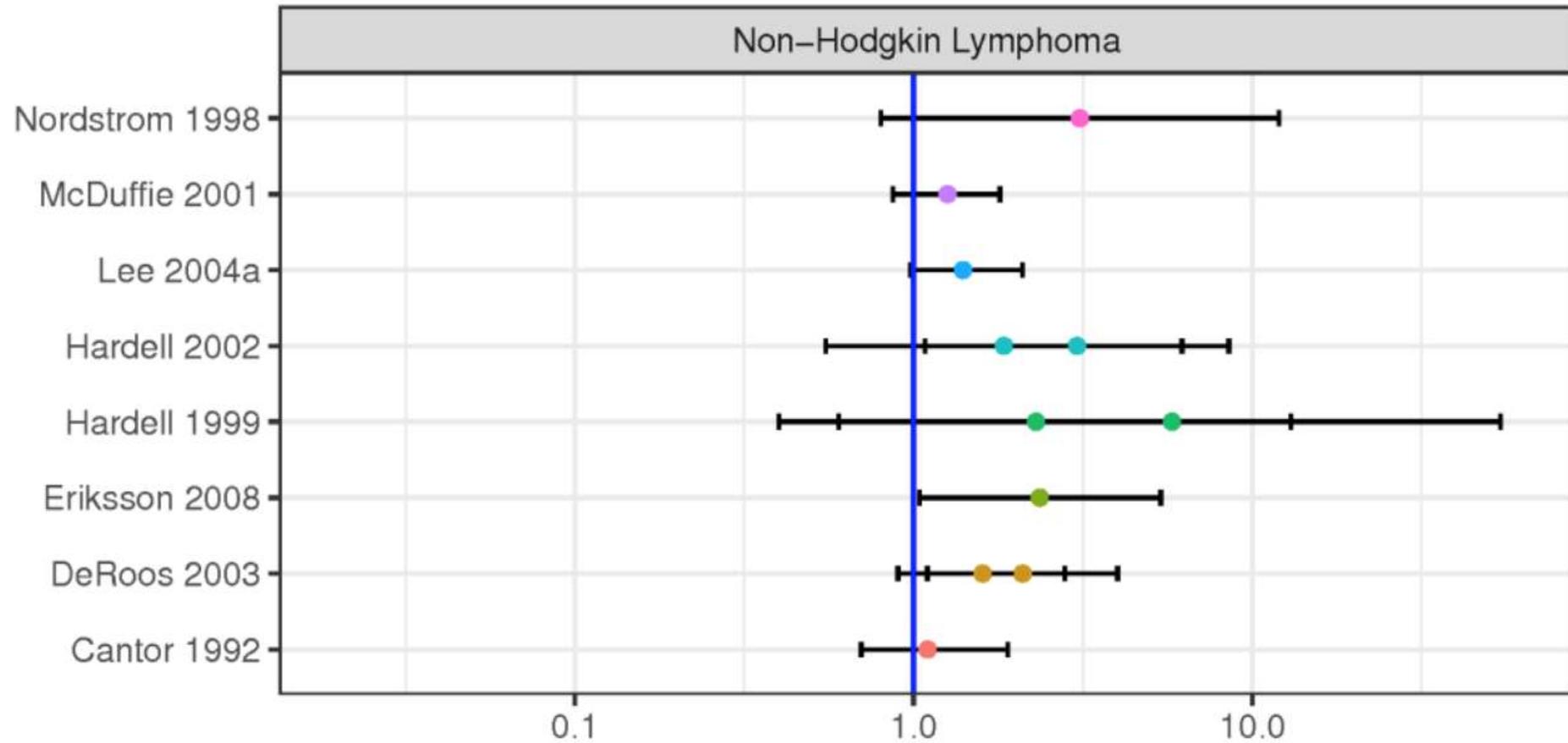
## Glyphosate and Cancer



HERBICIDES / RESEARCH

# Glyphosate and cancer – revisited

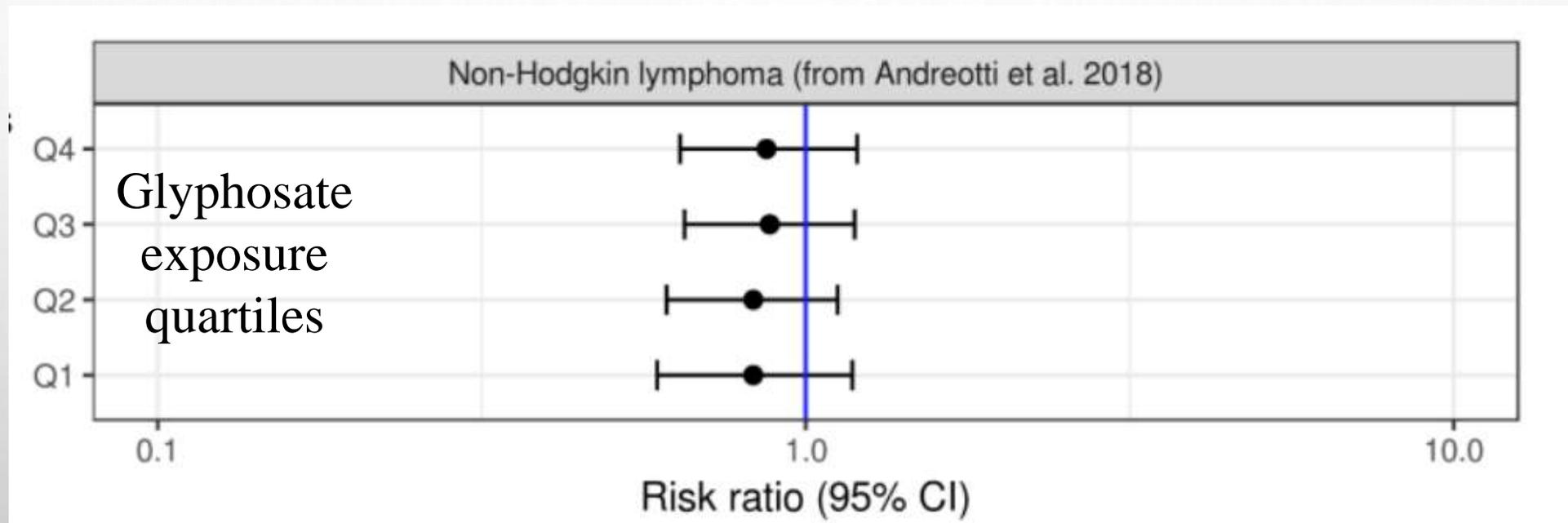
August 11, 2018 - by Andrew Kniss



HERBICIDES / RESEARCH

# Glyphosate and cancer – revisited

August 11, 2018 - by Andrew Kniss



HERBICIDES / RESEARCH

## Glyphosate and cancer – revisited

August 11, 2018 - by Andrew Kniss

RETAIL • PET FOOD

## A \$5 Million Lawsuit Claims Rachael Ray's Dog Food Brand Contains a Potentially Harmful Ingredient



A man from New York is suing Rachael Ray's "natural" dog food brand, Nutrish, for allegedly containing the "potentially harmful" herbicide glyphosate. In the \$5 million class action lawsuit, Bronx resident Markeith Parks argues that it is deceiving for Nutrish to market its food as natural.



# WEED KILLER INGREDIENT FOUND IN CHEERIOS, QUAKER OATS AND OTHER BREAKFAST CEREALS

BY CAMMY HARBISON ON 8/15/18 AT 11:59 PM

Fri, Aug 17, 2018

## Newsweek





The agency discovered that more than 53 percent of samples had no detectable pesticide residues, and all the residues found in the corn and soybean samples were below the tolerance levels set by EPA. No amounts of glyphosate or glufosinate were found in milk or eggs.

## **First ever FDA glyphosate study finds weed killer exposure 'not concerning for public health'**

Liz Crampton | Politico | October 2, 2018

The research, published in the journal [Proceedings of the National Academy of Sciences](#), finds that honeybees exposed to [glyphosate](#), the active ingredient in the [Monsanto weed killer](#), lose some of the beneficial bacteria in their guts, thereby becoming more susceptible to infection and death from harmful bacteria.

By ASHLEY WELCH / CBS NEWS / September 26, 2018, 4:45 PM

## **Roundup weed killer may play role in widespread bee deaths, study finds**



Glyphosate concentrations in run-off are a million times smaller after real-world applications

## Glyphosate perturbs the gut microbiota of honey bees

Erick V. S. Motta<sup>a,1</sup>, Kasie Raymann<sup>a,2</sup>, and Nancy A. Moran<sup>a,1</sup>

<sup>a</sup>Department of Integrative Biology, University of Texas at Austin, Austin, TX 78712

Edited by Margaret J. McFall-Ngai, University of Hawaii at Manoa, Honolulu, HI, and approved August 21, 2018 (received for review March 6, 2018)

Glyphosate, the primary herbicide used globally for weed control, targets the 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) enzyme in the shikimate pathway found in plants and some microorganisms. Thus, glyphosate may affect bacterial symbionts of animals living near agricultural sites, including pollinators such

herbicide is known to affect the growth of microorganisms (13–15), and the health of bees is intrinsically related to their distinct gut microbial community (16, 17). The honey bee gut microbiota is dominated by eight bacterial species: *Lactobacillus* spp. Firm-4, *Lactobacillus* spp. Firm-5 (phylum Firmicutes), *Bifidobacte-*

NEWS IN BRIEF

# Raid Recalls Entire Line Of Insecticide After Realizing Food Chain Would Collapse Without Bugs

8/28/18 11:30am • SEE MORE: BUSINESS ▾



RACINE, WI—Begging consumers to immediately cease endangering the safety of our ecosystem, consumer chemical manufacturer S.C. Johnson &

# PESTICIDE RESEARCH UPDATES

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KACI BUHL, ASSOCIATE PROFESSOR OF PRACTICE

OREGON STATE UNIVERSITY

**Oregon State**  
UNIVERSITY

# THOUGHTS?

- READ THE WHOLE LABEL, RE-READ ANNUALLY OR WITH NEW SHIPMENT
- FOLLOW ALL LABEL REQUIREMENTS/INSTRUCTIONS-ALWAYS WEAR MINIMUM PPES!!
- EVERYTHING HAS RISK- ASK QUESTIONS!!!
- CONSULT REPUTABLE SOURCE-CONSIDER NPIC
- BE KNOWLEDGEABLE ABOUT NEW STUDIES, NEW HEADLINES-TALK WITH YOUR CREW
- LISTEN CAREFULLY-BE PREPARED TO ADDRESS PUBLIC CONCERNS
- HOW WOULD YOU CHANGE YOUR PROGRAM IN RESPONSE TO NEW INFORMATION OR CONCERNS?
- BE PREPARED TO EXPLAIN HOW YOUR PROGRAM REDUCES RISK, MAXIMIZES BENEFITS