

Ærøs drikkevand, Pesticider og Parkinsons sygdom

Jan Bert Gramsbergen, DN Ærø, Årsmøde d. 22. oktober 2024

- Vi risikerer at løbe tør for rent drikkevand.
- Der er rester af pesticider i **alle** aktive drikkevandsboringer og halvdelen overstiger grænseværdier.
- Pesticider øger risiko for Parkinsons sygdom
- Pesticider øger risiko for kræft
- Myndighederne har ikke styr på hvilke sprøjtegifte der bruges på indvindingsområder for drikkevandet



bomlærke

Europe has lost 550 million birds in 40 years. The single biggest cause?

Pesticides and fertilisers

**Danmark:
3 millioner fugle er forsvundet fra det åbne land**

På bare 40 år har Danmark mistet knap tre millioner fugle, som er særlig knyttet til landbrugslandet.

Dansk Ornitologisk Forening
6. februar 2018

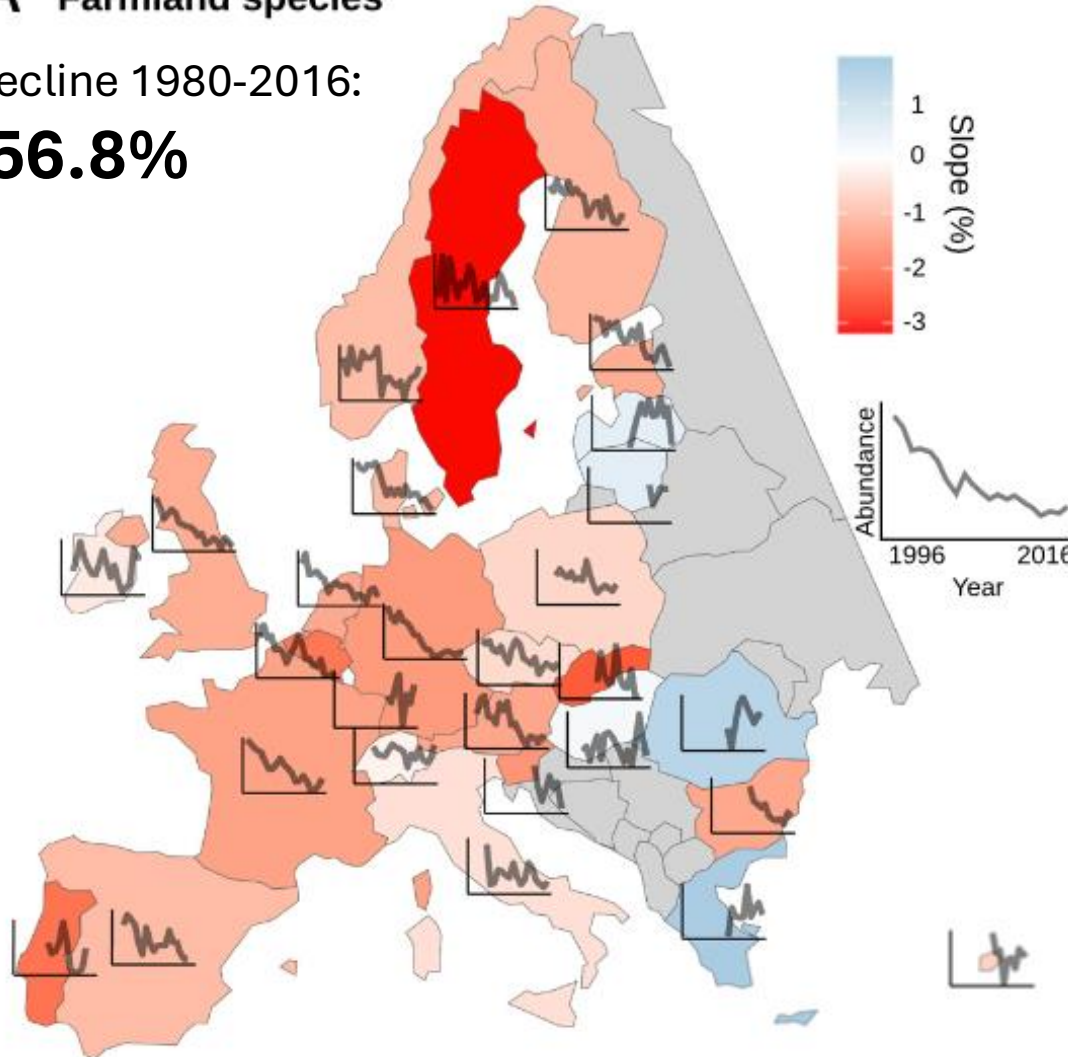
Farmland practices are driving bird population decline across Europe

Rigal et al. *PNAS* 2023 Vol. 120 No. 21 e2216573120

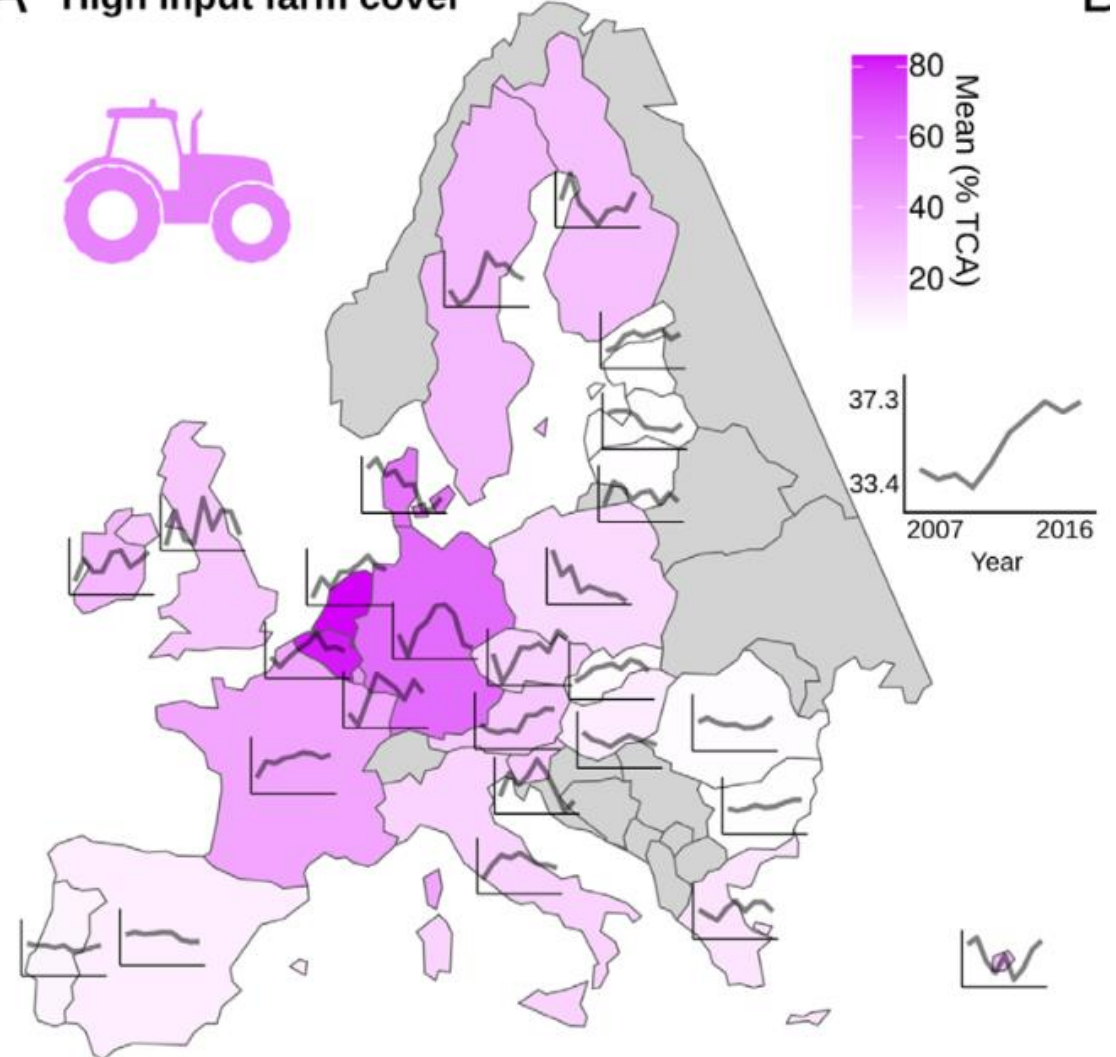
A Farmland species

Decline 1980-2016:

-56.8%



A High input farm cover



E

Spørgsmål

- Hvilke sprøjtemidler bruges på indvindingsområder til drikkevandet på Ærø?
- Hvilke aktivstoffer er der i de anvendte sprøjtemidler og hvilke nedbrydningsprodukter kan man forvente i grundvandet?
- Bliver grundvandet og drikkevandet screenet for alle aktivstoffer og/eller deres nedbrydningsprodukter?
- Hvor giftigt er de anvendte sprøjtemidler ved eksponering?
(via indånding, hudkontakt og/eller indtag via mad eller drikkevandet)
- Hvor giftigt er de fundne pesticidrester i drikkevandet?
- Er de anvendte sprøjtemidler koblet til Parkinsons sygdom?
- Hvad kan landmænd og Ærø Kommune gøre for at beskytte Ærøs befolkning (og turister) mod de sundhedsskadelige effekter af pesticider?

Giftig mistanke: Sprøjtemidler bag eksplosiv vækst i Parkinsons sygdom

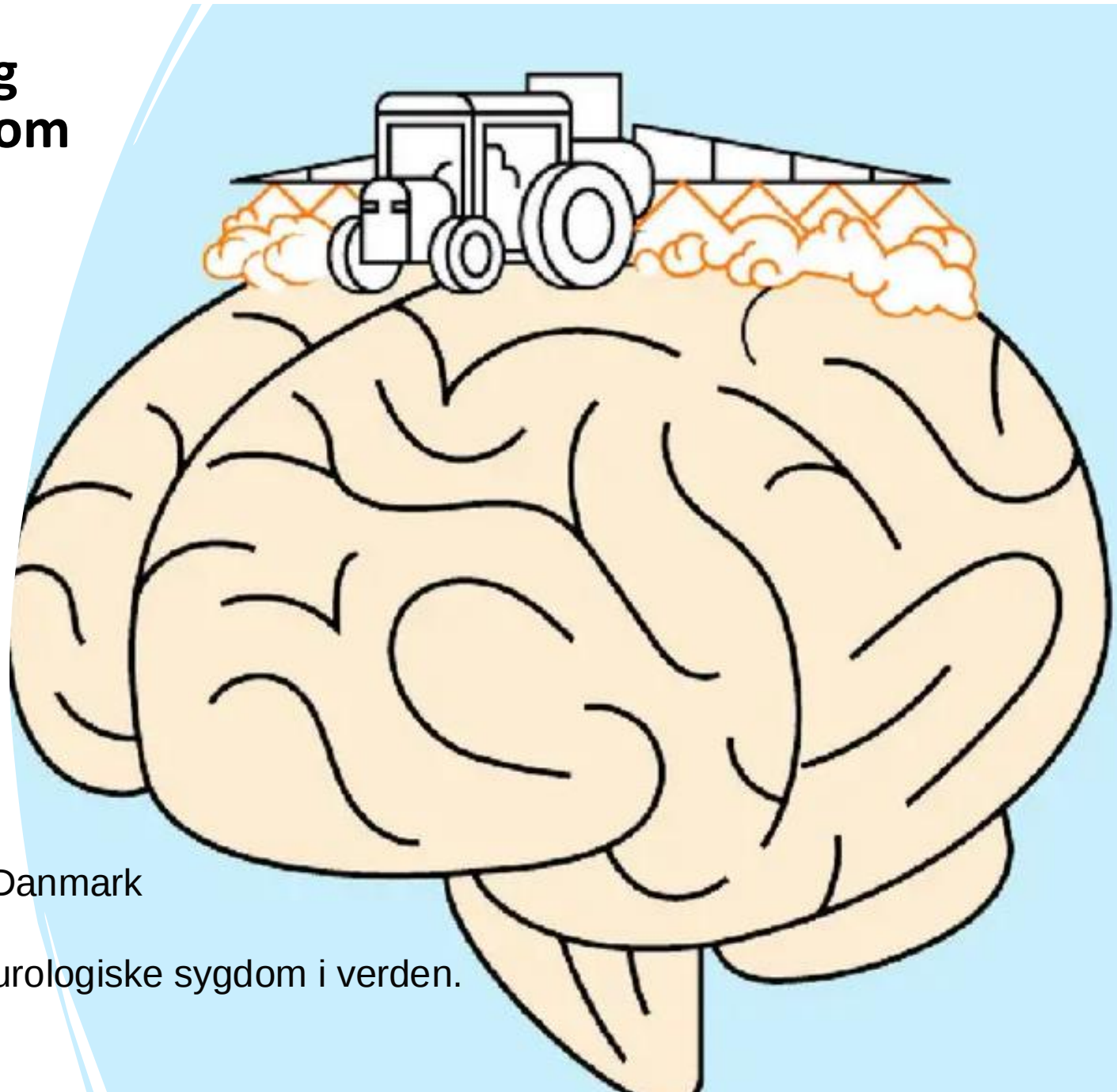


UGESKRIFT
FOR LÆGER

Antje Gerd Poulsen
29. feb. 2024

Allan Svendsen købte i 1980'erne en marksprøjte til sit landbrug på Nordfyn. Han havde hverken handsker eller maske på når han arbejdede med sprøjtemidler. Han troede ikke, det var giftigt. Allan Svendsen døde i 2022. Da var han hårdt angrebet af en uhelbredelig og fremadskridende neurologisk sygdom, Parkinsons sygdom.

I 2019 var der ca. 12.000 Parkinsons patienter i Danmark
I 2040 forventes over 20.000 patienter
Parkinsons sygdom er den hurtigst voksende neurologiske sygdom i verden.



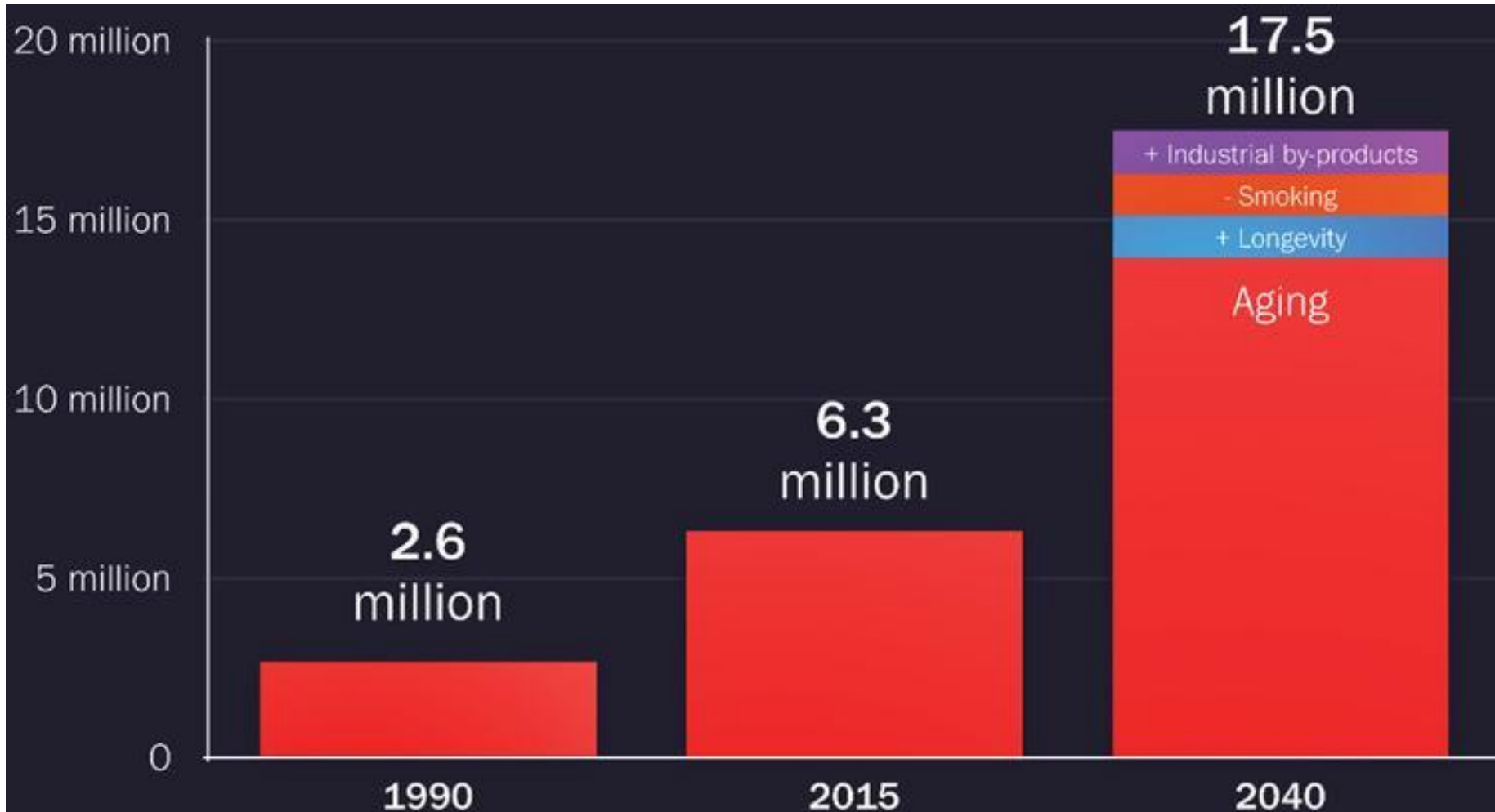
Nøgletal fra Danmarks statistik

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
B-051 Parkinsons sygdom (paralysis agitans)	297	301	274	334	312	335	387	412	451	502	468	523	575	615	699	746



The Emerging Evidence of the Parkinson Pandemic

E. Ray Dorsey, Todd Sherer, Michael S. Okun and Bastiaan R. Bloem, Journal of Parkinson's Disease 8 (2018) S3–S8



20. März 2024

Empfehlung für neue Berufskrankheit "Parkinson-Syndrom durch Pestizide" beschlossen

Der Ärztliche Sachverständigenbeirat Berufskrankheiten (ÄSVB) beim Bundesministerium für Arbeit und Soziales hat eine wissenschaftliche Empfehlung für eine neue Berufskrankheit "Parkinson-Syndrom durch Pestizide" beschlossen. Der Empfehlung ging ein langjähriger, sehr intensiver Beratungsprozess voraus, in dessen Verlauf der ÄSVB eine große Anzahl internationaler wissenschaftlicher Studien auswertete.

The scientific bases to consider Parkinson's disease an occupational disease in agriculture professionals exposed to pesticides in France – since 2012

Elbaz A, Moisan F. , J Epidemiol Community Health 2016;70:319–321.



Pesticides and Parkinson's Disease. A well-established causal relationship. Measures to protect all citizens.

Author

Romain Rigal, MSc, Service Development Coordinator, Parkinson Québec

Editor

Nicole Charpentier, BSc OT, Executive Director, Parkinson Québec

- Occupational exposure to pesticides doubles or even triples the risk of developing PD. Pesticide applicators and grain producers are particularly at risk.
- Residential exposure within 500 metres of where a combination of rotenone, maneb and ziram have been applied, almost doubles the risk of developing PD.
- People who experience 10 days of exposure per year are 2.5 times more likely to develop PD.
- People who have been exposed to pesticides during their childhood are up to 6 times more likely to develop PD.
- Simultaneous exposure to several different pesticides, as is the case in our everyday environment, leads to a potentiation of the toxic effects of each product.

Parkinson sygdom: Symptomer



Non-motoriske symptomer: søvnforstyrrelser, depression, kognitive symptomer, mave- og blæresymptomer.

Prævalens af Parkinsons

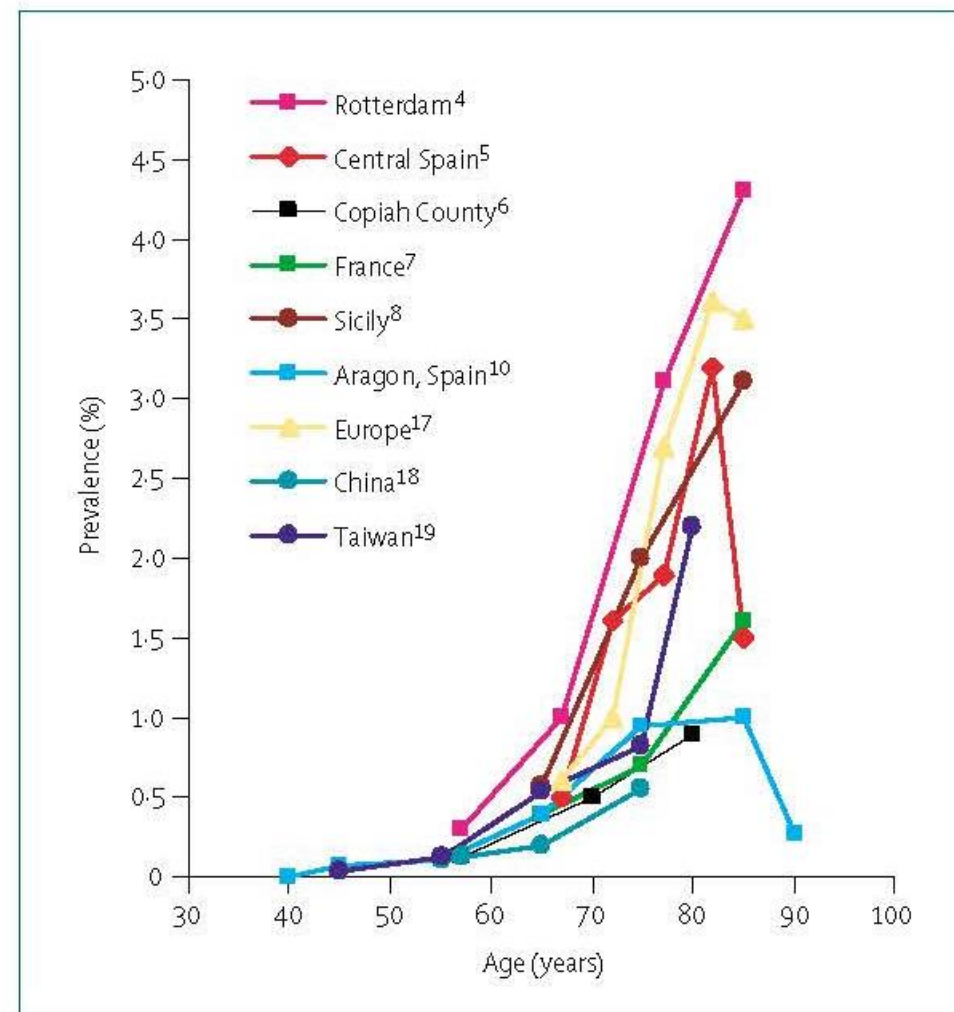
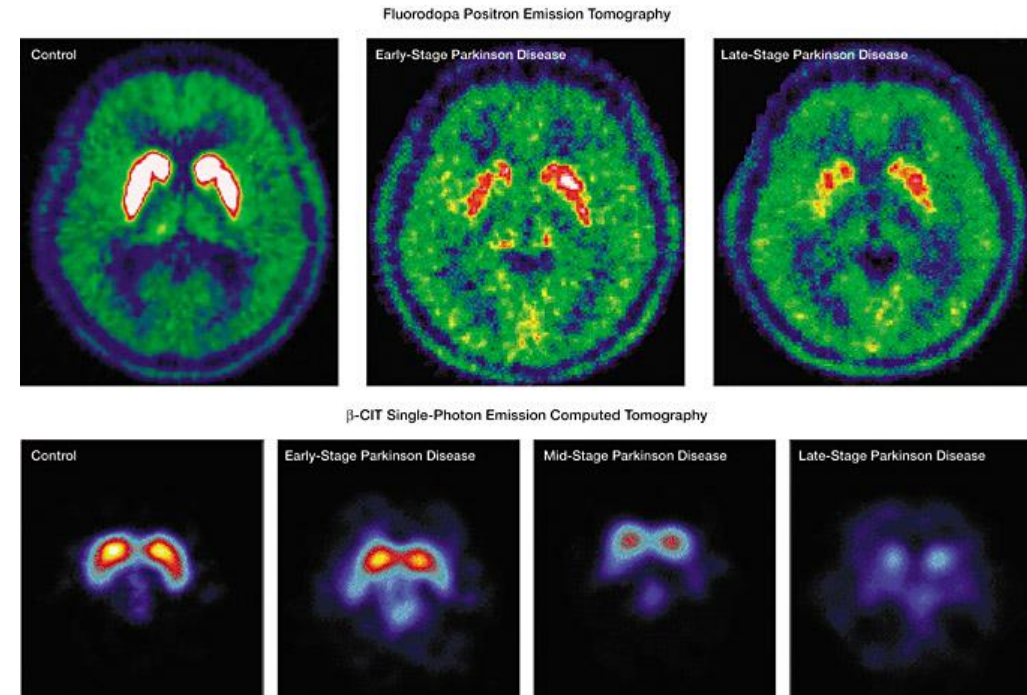
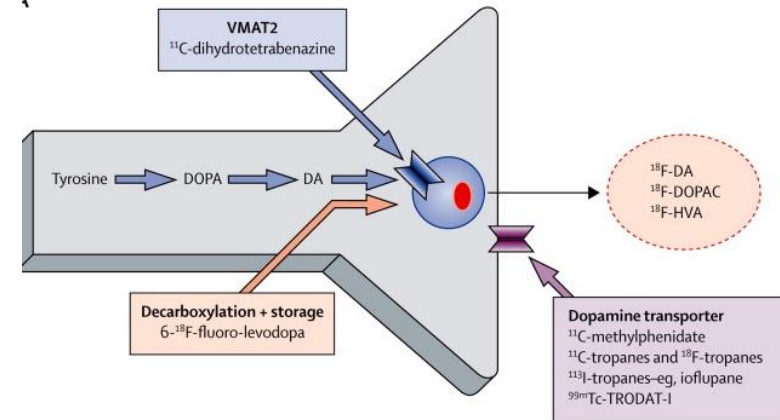
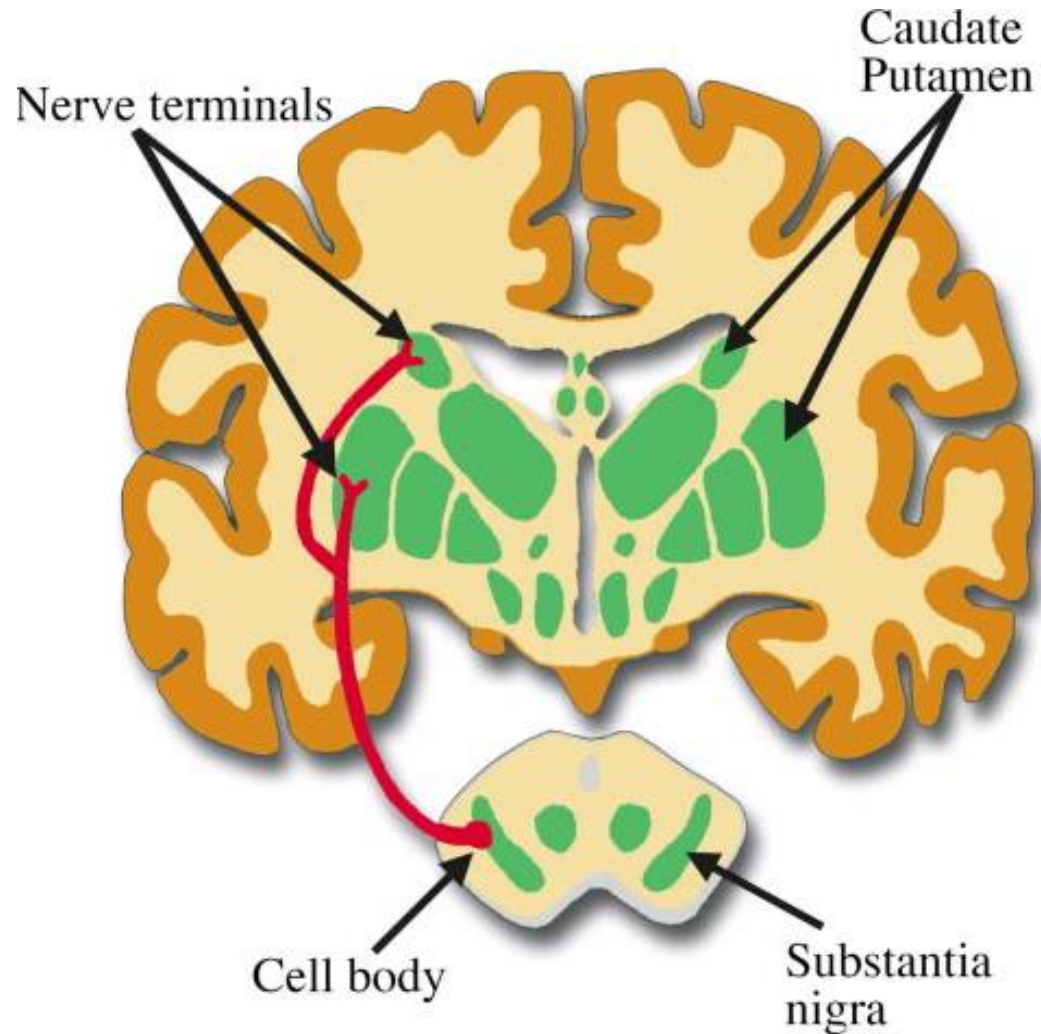


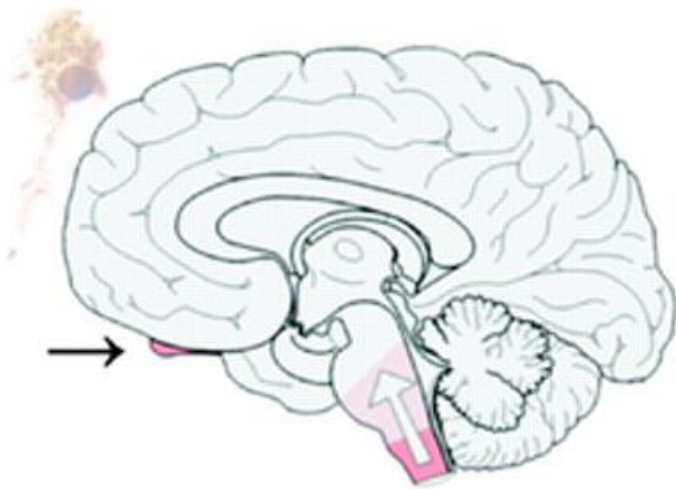
Figure 1: Population-based prevalence studies of Parkinson's disease

Nigrostriatal cell loss and dopamine depletion in Parkinson's disease



Braak Parkinson's disease stages

(Braak et al. 2003, Neurobiol. Aging 24, 109-211)



Braak Parkinson's disease stages 1 & 2
PRECLINICAL

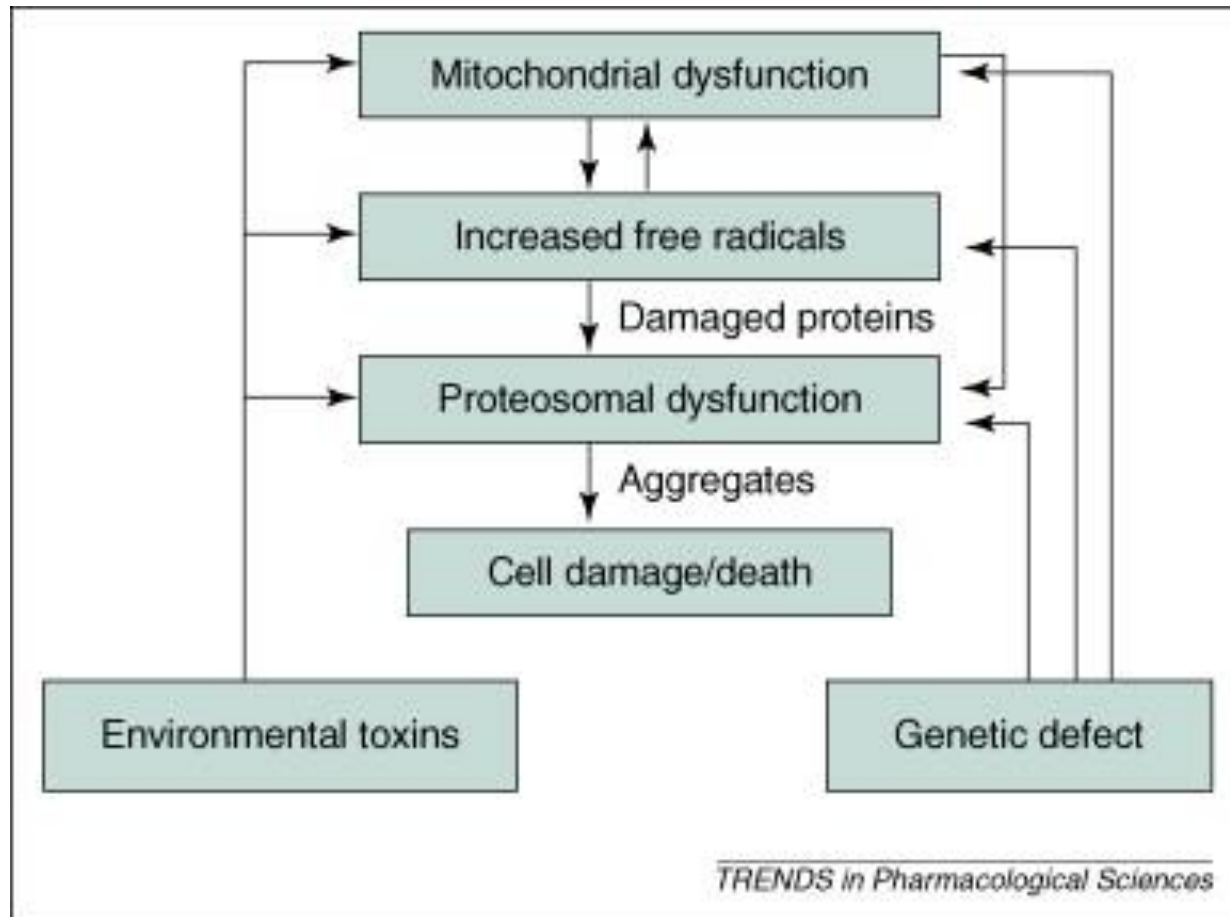


Braak Parkinson's disease stages 3 & 4
CLINICAL PARKINSON'S DISEASE



Braak Parkinson's disease stages 5 & 6
COGNITIVE IMPAIRMENT

Pathogenesis of Parkinson's disease



Rotenone, Paraquat, and Parkinson's Disease

Caroline M. Tanner et al.

Environ Health Perspect 119:866–872 (2011). doi:10.1289/ehp.1002839

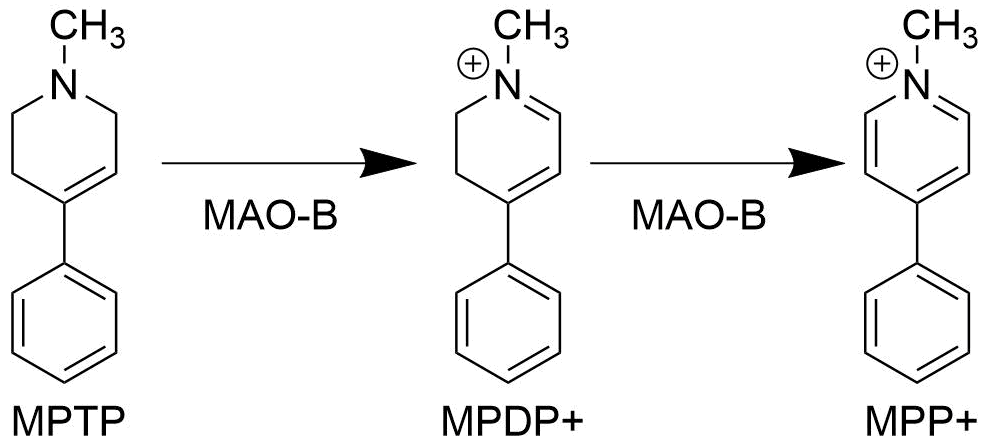
Results: In 110 PD cases and 358 controls, PD was associated with use of a group of pesticides that inhibit mitochondrial complex I, including rotenone and with use of a group of pesticides that cause oxidative stress, including paraquat (OR = 2.5; 95% CI, 1.4–4.7).

Pesticide use in agriculture and Parkinson's disease in the AGRICAN cohort study

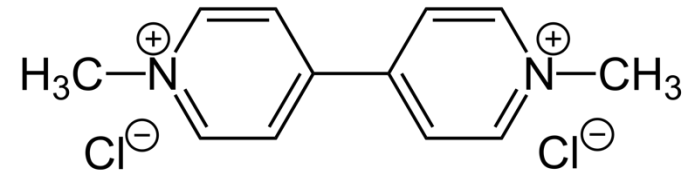
Camille Pouchieu et al.

International Journal of Epidemiology, 2018, 299–310

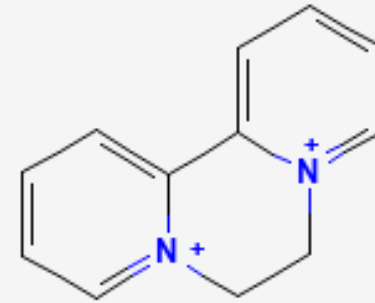
Results: PD was reported by 1732 subjects (1.2%) at enrolment in the cohort. Pesticide use lifelong was associated with an increased risk of PD in all types of activities. Rotenone, diquat, paraquat and several dithiocarbamates were associated with an increased risk of PD, especially in farmers with the longest exposure.



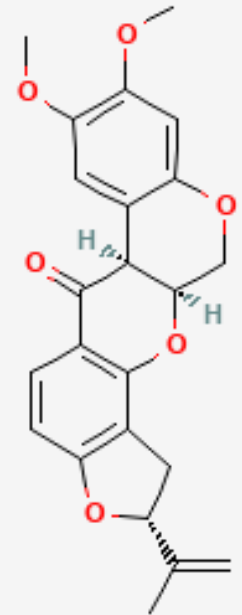
1-methyl-4-phenylpyridinium
(herbicide)



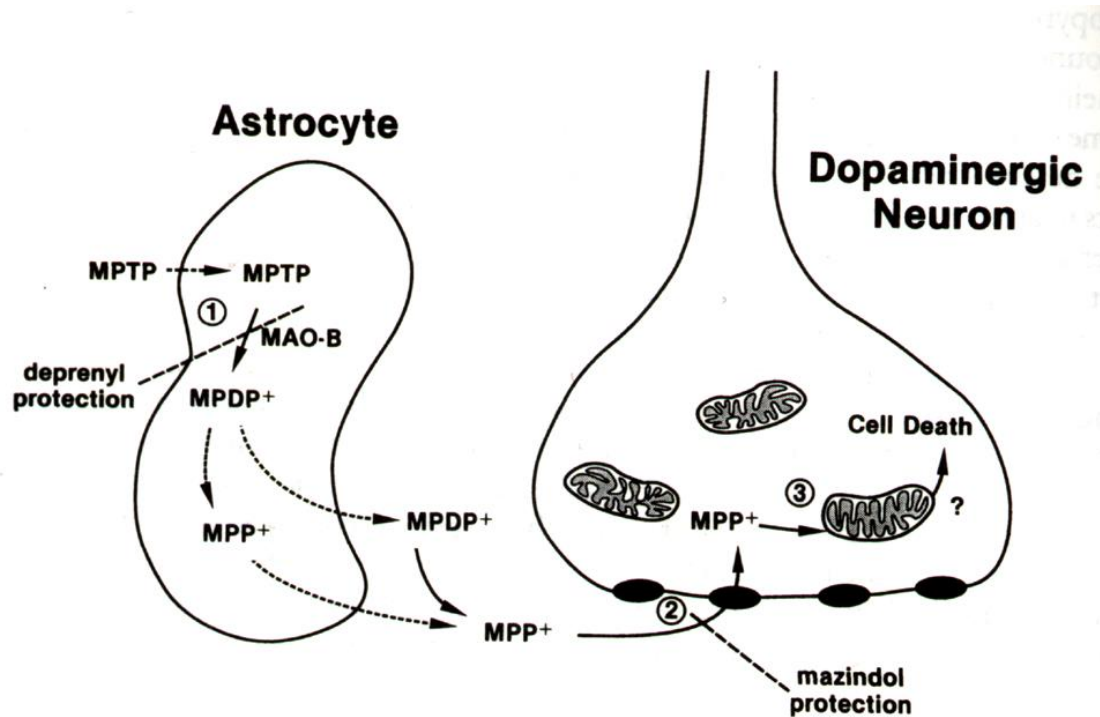
Paraquat (herbicide)

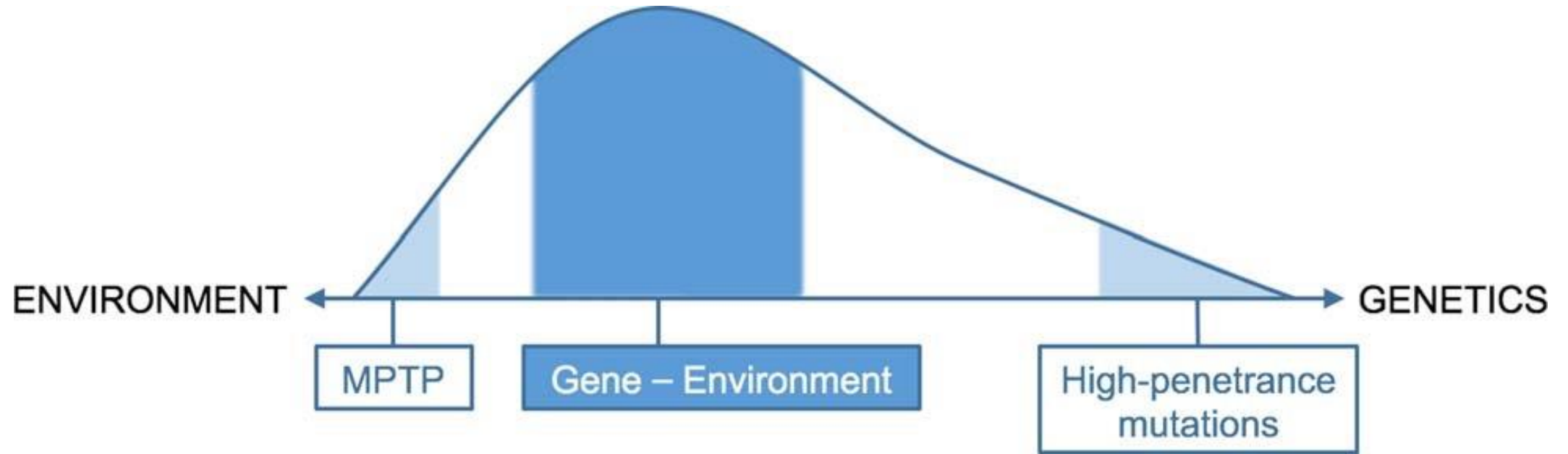


Diquat (herbicide)



Rotenone (insecticide)



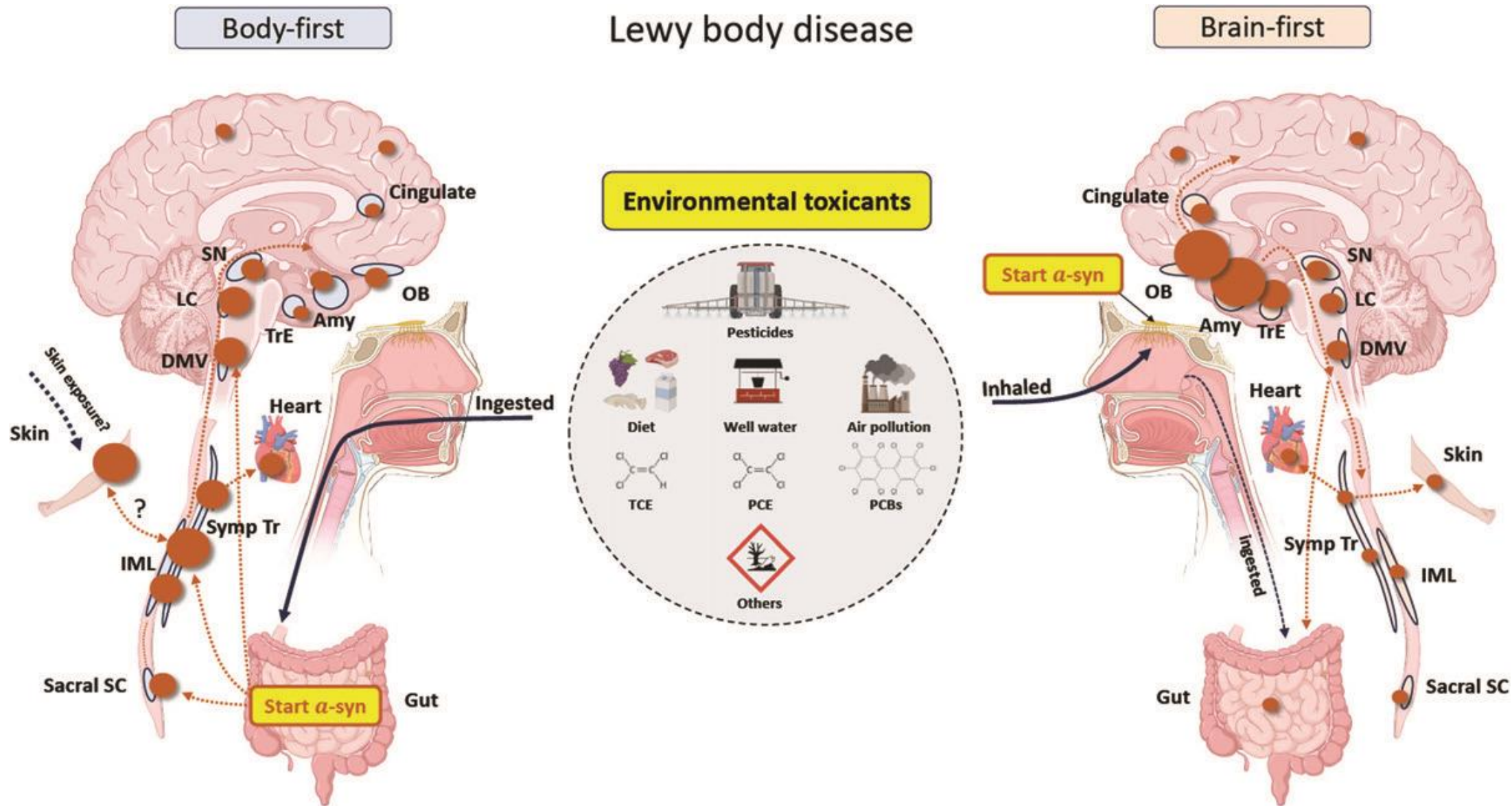


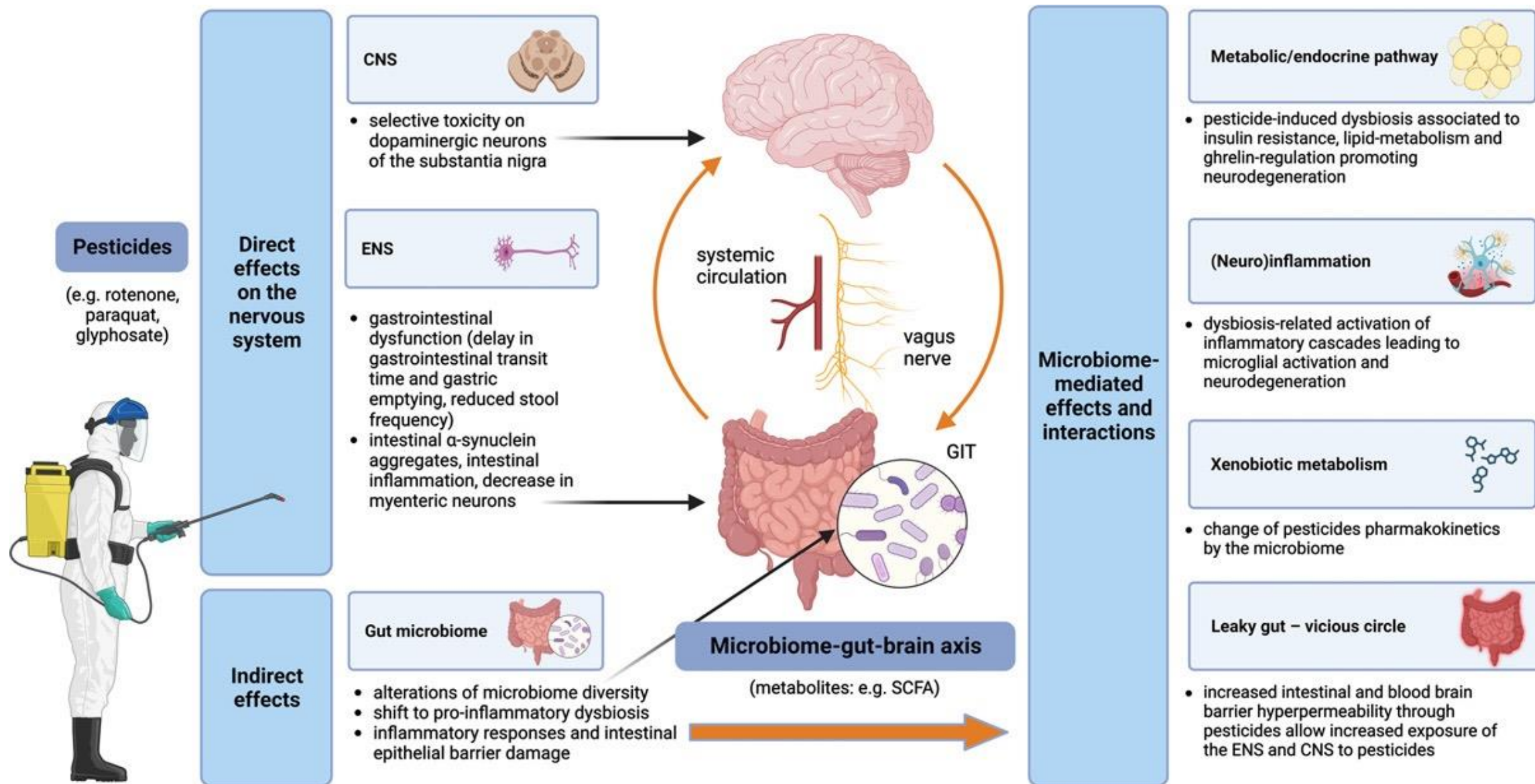
<https://doi.org/10.1038/s41531-024-00703-4>

Lysosomal genes contribute to Parkinson's disease near agriculture with high intensity pesticide use



Kathie J. Ngo ^{1,6}, Kimberly C. Paul^{1,6}, Darice Wong^{1,2}, Cynthia D. J. Kusters³, Jeff M. Bronstein¹,
Beate Ritz ^{1,3,4} & Brent L. Fogel ^{1,2,5} ✉

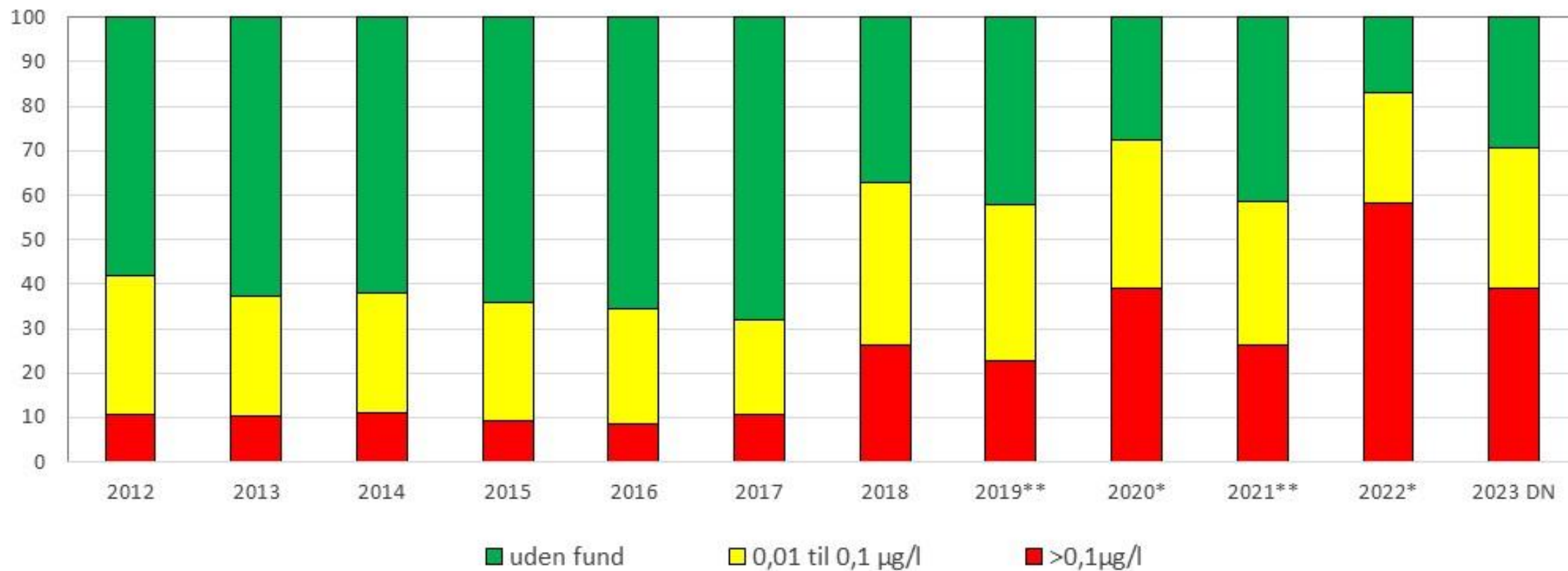




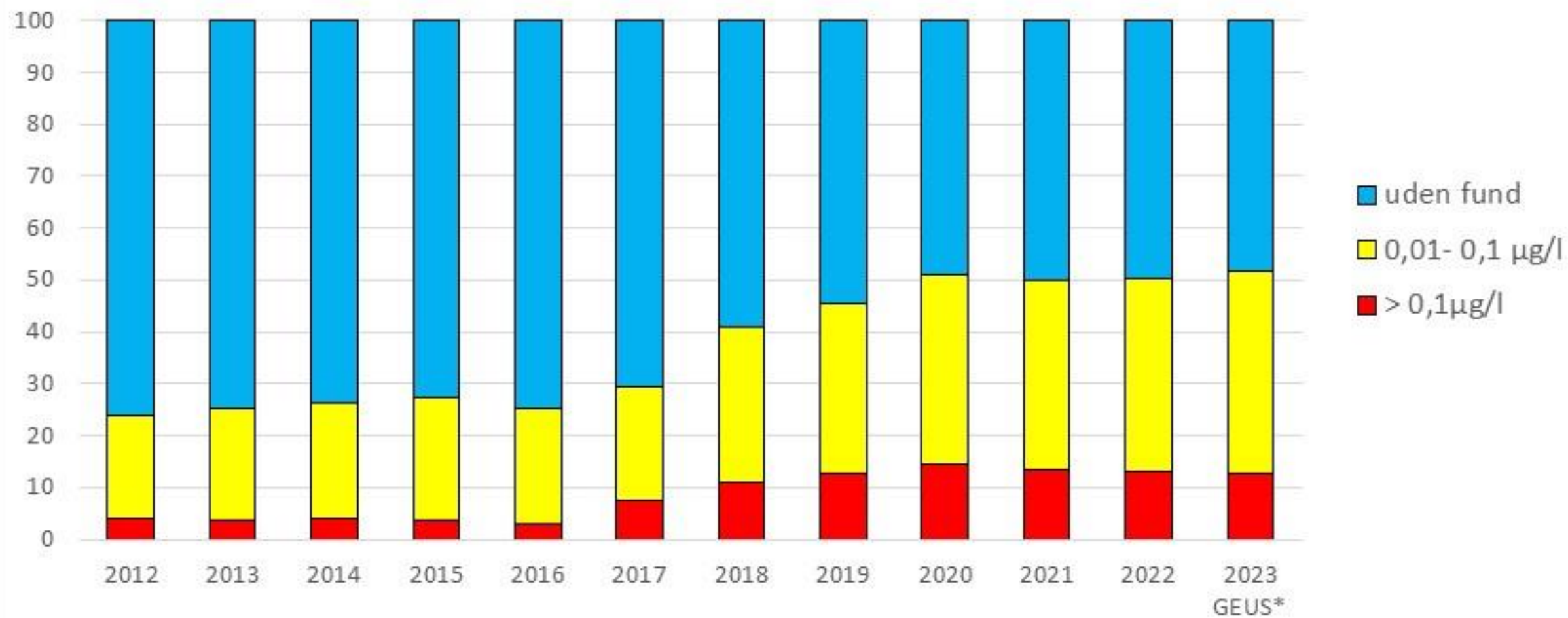
Grundvandsovervågningen 2012-2023

Indtag med fund af sprøjtegiftrester (%)

*2023 - DN's opgørelse **2019 og 2021 GEUS operationel overvågning *2020 og 2022 GEUS kontrolovervågning



Sprøjtegiftrester i aktive danske vandværksboringer 2012 til 2023(%)



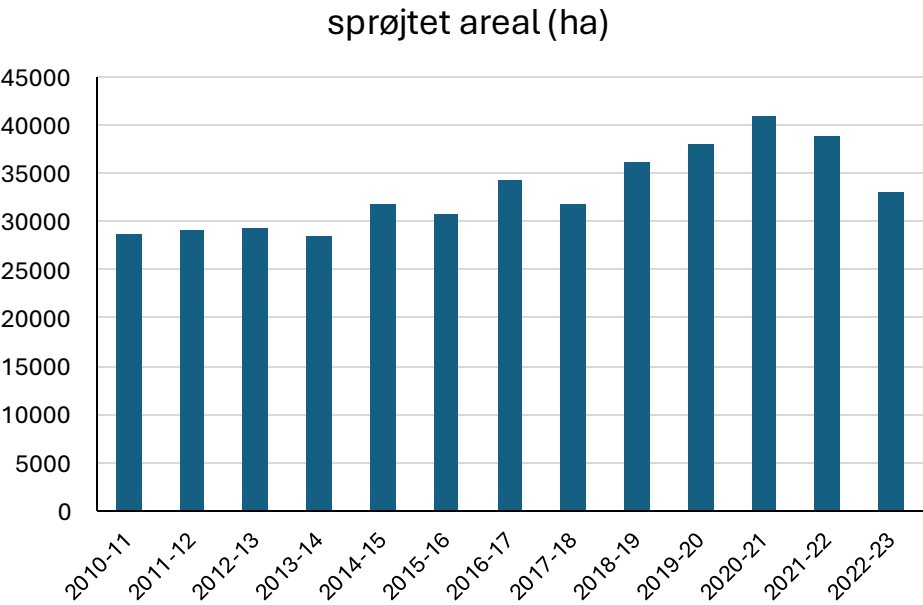
Databaser

- Boringer med fund af pesticidrester Ærø (Walter Brüscher, DN)
- Rise Vandværk:
<https://data.geus.dk/JupiterWWW/vandanalyse.jsp?anlaegid=82864>
- Indberettede pesticidjournaler (aktindsigt fra Miljøstyrelsen)
- Middeldatabasen <https://middeldatabasen.dk>
- Pesticide Properties DataBase
<http://sitem.herts.ac.uk/aeru/ppdb/en/index.htm>
- PubChem <https://pubchem.ncbi.nlm.nih.gov>

Fremgangsmåde

- Pesticidjournaler 2010-2023 → pesticid navne → aktivstoffer → IUPAC navn, cas nr. (hvilke pesticider og aktivstoffer bruges på Ærø?)
- Company name (Landbrug) → afgrøde → areal og antal sprøjtninger i år 2022-23 (hvor tid sprøjtes en kornmark?)
- Aktivstoffer
 - dosis og areal i alt (hvilke stoffer er brugt mest?)
 - dosis og areal per år (stiger er falder forbruget?)
 - mode of action (virkningsmekanisme – relevans for Parkinsons sygdom?)
 - environmental fate, ecotoxicity, human health (hvor giftigt er stofferne?)
 - nedbrydningsprodukter (screenes drikkevandet for disse stoffer?)
- Nedbrydningsprodukter → environmental fate, ecotoxicity, human health (hvor giftigt er pesticidrester i drikkevandet?)

Hvor stort areal sprøjtes per år?



År	sprøjtet areal	div. Ærø land
2010-11	28614,9	4,47
2011-12	29197,48	4,56
2012-13	29290,64	4,57
2013-14	28597,17	4,47
2014-15	31731,1	4,95
2015-16	30781,69	4,81
2016-17	34375,38	5,37
2017-18	31924,86	4,99
2018-19	36122,6	5,64
2019-20	38005,96	5,93
2020-21	40963,89	6,40
2021-22	38980,43	6,09
2022-23	33093,57	5,17

Herbicide	2,4-D
Herbicide	aclonifen
Herbicide	aminopyralid
Herbicide	asulam
Herbicide	bentazone
Herbicide	bifenox
Herbicide	bromoxynil
Herbicide	clodinafop-propargyl
Herbicide	clomazone
Herbicide	clopyralid
Herbicide	cloquintocet-mexyl
Herbicide	cycloxydim
Herbicide	desmedipham
Herbicide	diflufenican
Herbicide	diquat dibromid
Herbicide	ethofumesat
Herbicide	fenoxaprop-P-ethyl
Herbicide	florasulam
Herbicide	flupyr-sulfuron-methyl-Na
Herbicide	Fluroxypyr
Herbicide	foramsulfuron
Herbicide	glyphosat
Herbicide	halauxifen-methyl
Herbicide	iodosulfuron-methyl-sodium
Herbicide	ioxynil
Herbicide	isoxadifen-ethyl
Herbicide	MCPA
Herbicide	mefenpyr-diethyl
Herbicide	mesosulfuron-methyl
Herbicide	mesotrion
Herbicide	metamitron
Herbicide	metobromuron
Herbicide	metsulfuron-methyl
Herbicide	pendimethalin
Herbicide	phenmedipham
Herbicide	picloram
Herbicide	picolinafen
Herbicide	propaquizafop

Herbicide	propyzamide
Herbicide	prosulfocarb
Herbicide	pyroxsulam
Herbicide	sulfosulfuron
Herbicide	Thifensulfuron-methyl
Herbicide	tralkoxydim
Herbicide	tribenuron-methyl
Herbicide	triflurosulfuron-methyl

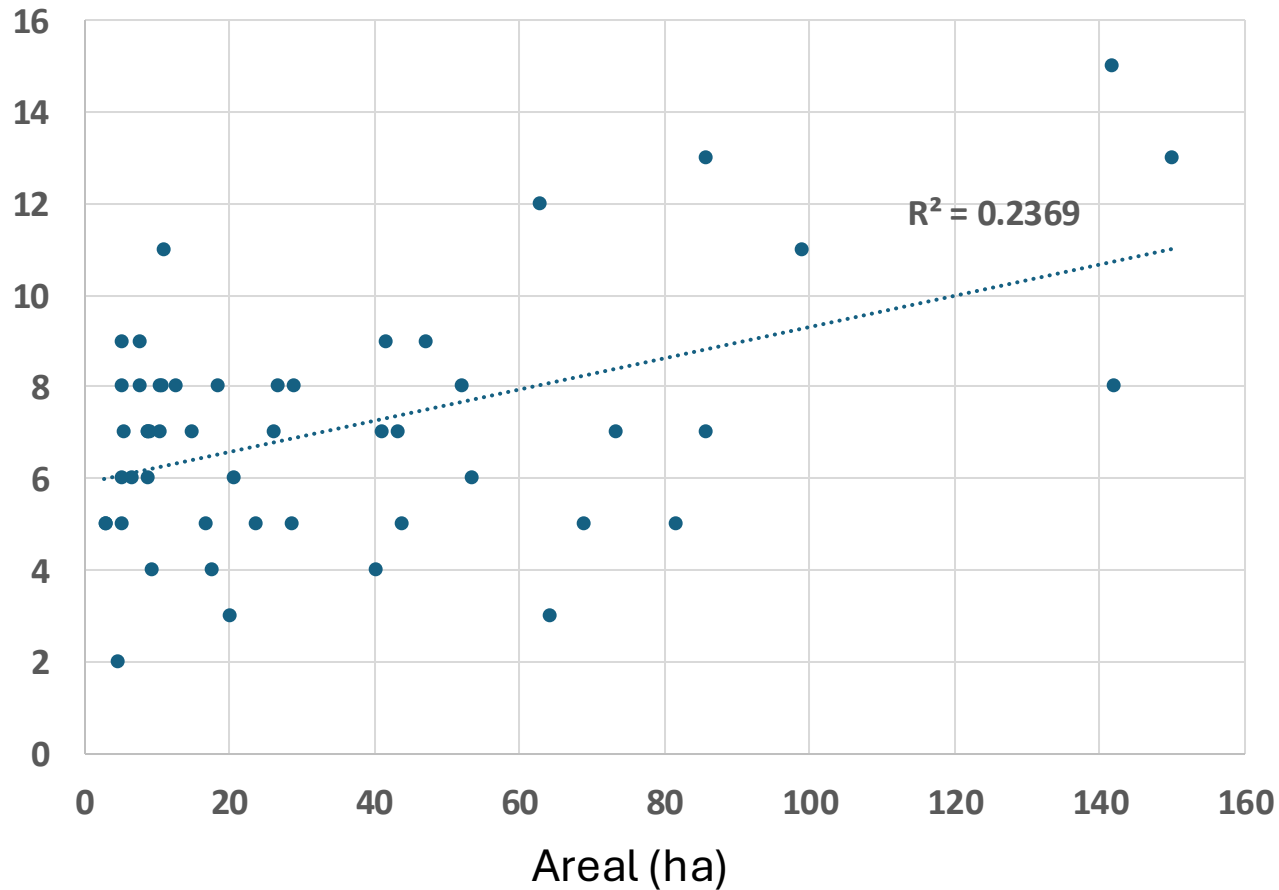
Bejdsemiddel	carboxin
Bejdsemiddel	imazalil
Fungicide	azoxystrobin
Fungicide	boscalid
Fungicide	cyprodinil
Fungicide	difenoconazole
Fungicide	dodermorph acetate
Fungicide	epoxiconazole
Fungicide	fenpropidin
Fungicide	fludioxonil
Fungicide	fluopyram
Fungicide	mandipropamid
Fungicide	maneb
Fungicide	mefentrifluconazole
Fungicide	metconazole
Fungicide	metrafenon
Fungicide	picoxystrobin
Fungicide	propiconazole
Fungicide	proquinazid
Fungicide	prothioconazole
Fungicide	pyraclostrobin
Fungicide	svovl
Fungicide	tebuconazole

Sneglemiddel	jern(III)fosfat
Vækstreg.	chlormequat-chlorid
Vækstreg.	ethephon
Vækstreg.	mepiquat-chlorid
Vækstreg.	prohexadion-calcium
Vækstreg.	trinexapac-ethyl

Insekticide	alpha-cypermethrin
Insekticide	azadirachtin
Insekticide	Bacillus thuringiensis subsp. kurstaki
Insekticide	ABTS-351
Insekticide	cypermethrin (cis:trans 40:60)
Insekticide	dodecan-1-ol
Insekticide	flonicamid
Insekticide	gamma-cyhalothrin
Insekticide	indoxacarb
Insekticide	lambda-cyhalothrin
Insekticide	pirimicarb
Insekticide	pyrethrin I og II
Insekticide	tau-fluvalinate
Insekticide	thiacloprid

Hvor tid sprøjtes pesticider på en kornmark?

Vinterhvede – sprøjtninger i år 2022-23

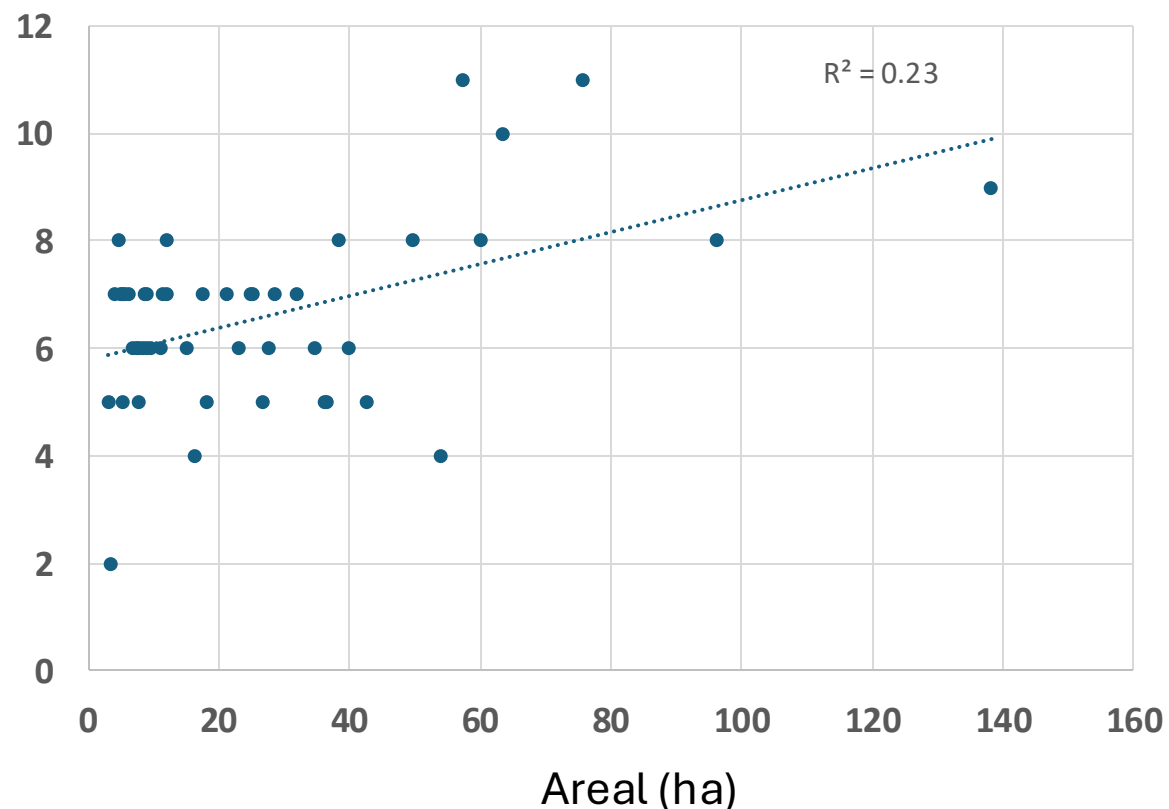


Areal vinterhvede i alt: 1807 ha (=28% af Ærø's landbrugsareal)

Pesticide Name	Type of Pesticide	Active Substance	
Atlantis OD	Herbicide	mefenpir-diethyl	
		iodosulfuron-methyl-sodium	
		mesosulfuron-methyl	
Balaya	Fungicide	pyraclostrobin	
		mefentrifluconazol	
Boxer	Herbicide	prosulfocarb	
Broadway (Tidl. Floramix Alpha)	Herbicide	florasulam	
		pyroxsulam	
		cloquintocet	
DFF	Herbicide	diflufenican	
Folicur Xpert EC 240	Fungicide	tebuconazole	
		prothioconazole	
Glyphomax HL	Herbicide	glyphosat	
Mateno Duo SC 600	Herbicide	aclonifen	
		diflufenican	
Mavrik	Insekticid	tau-fluvalinate	
Medax Top	Vækstregulering	mepiquat chloride	
		prohexadion-calcium	
Nuance Max 75 WG	Herbicide	tribenuron-methyl	
Orius Gold	Fungicide	tebuconazole	
Zypar	Herbicide	florasulam	
		halauxifen	
		cloquintocet	

Hvor tid sprøjtes pesticider på en kornmark?

Vårbyg – sprøjtninger i år 2022-23



PesticideName	Type of Pesticide	Active Subst.
Comet Pro (tidl. Comet 200)	Fungicid	pyraclostrobin
DFF	Herbicid	diflufenican
Folicur Xpert EC 240	Fungicid	tebuconazole
		prothioconazole
Foxtrot	Herbicid	fenoxaprop-P-ethyl
Hussar Plus OD	Herbicid	mefenpyr-diethyl
		iodosulfuron-methyl-sodium
		mesosulfuron-methyl
Lamdex	Insekticid	lambda-cyhalothrin
Pirimor 500 WG	Insekticid	pirimicarb
Zypar	Herbicide	florasulam
		halauxifen
		cloquintocet

Areal vårbyg i alt: 1264 ha (=20% af Ærø's landbrugsareal)



Article

<https://doi.org/10.1038/s41467-023-38215-z>

A pesticide and iPSC dopaminergic neuron screen identifies and classifies Parkinson-relevant pesticides

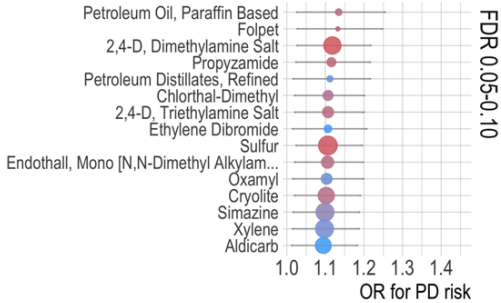
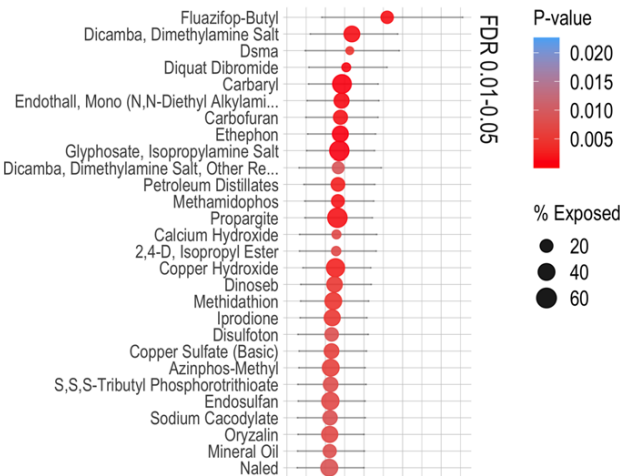
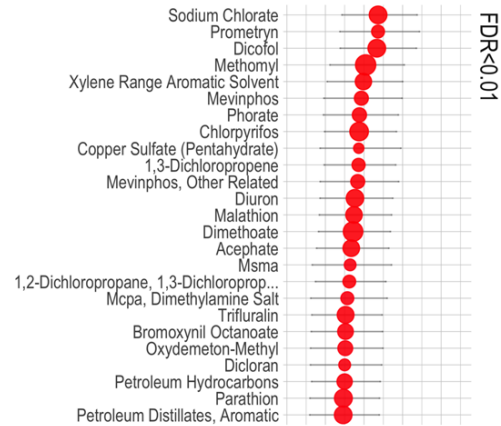
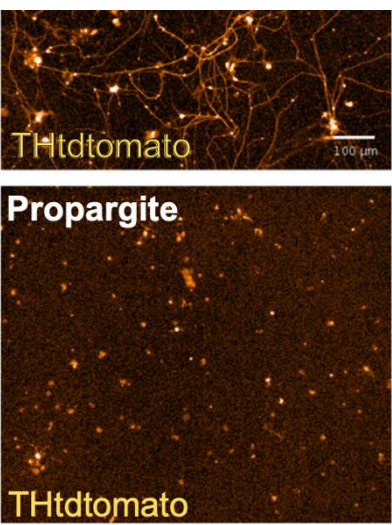
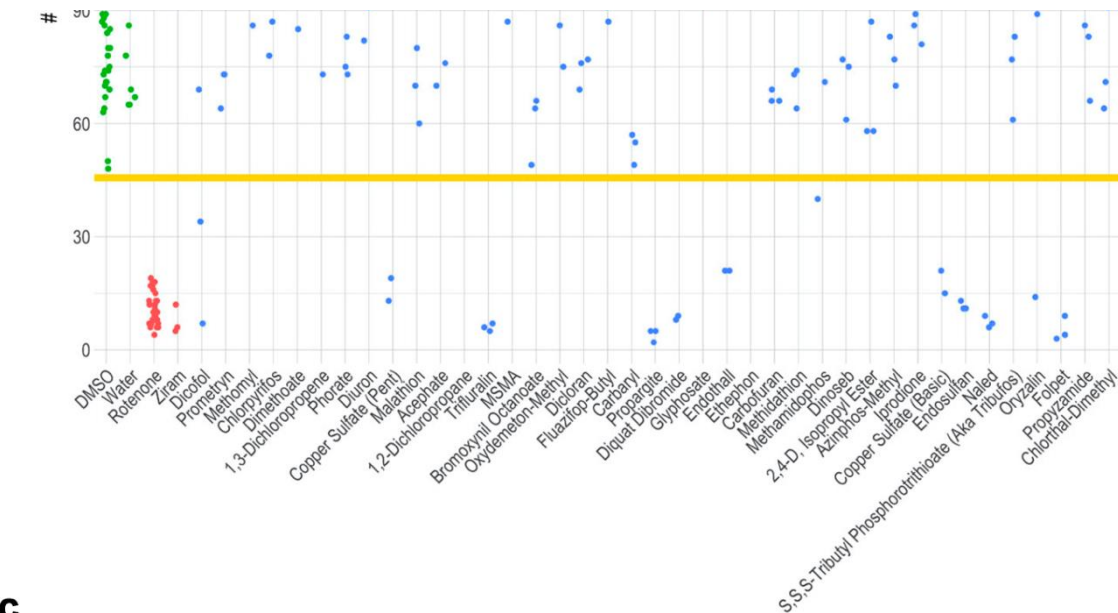
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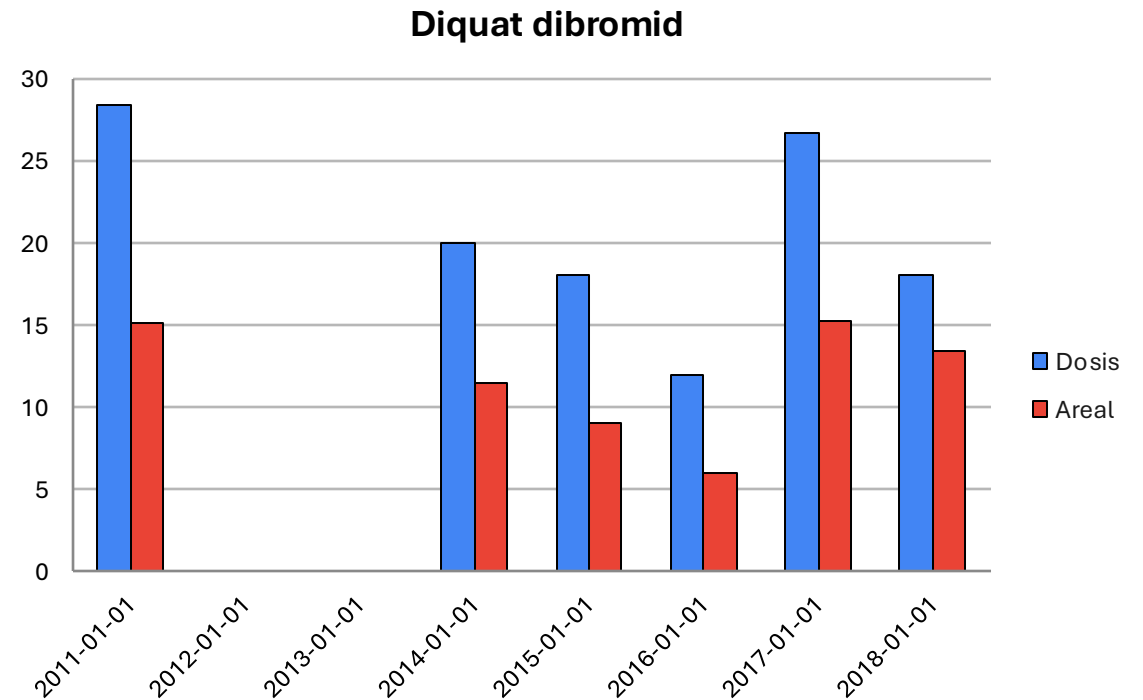
Check for updates

Kimberly C. Paul ^{1,14}✉, Richard C. Krolewski ^{2,3,14}, Edinson Lucumi Moreno², Jack Blank ¹¹, Kristina M. Holton³, Tim Ahfeldt^{12,13}, Melissa Furlong⁴, Yu Yu ⁵, Myles Cockburn⁶, Laura K. Thompson ⁶, Alexander Kreymerman³, Elisabeth M. Ricci-Blair³, Yu Jun Li³, Heer B. Patel³, Richard T. Lee ^{3,7,8}, Jeff Bronstein¹, Lee L. Rubin ^{3,7,15}✉, Vikram Khurana ^{2,9,15}✉ & Beate Ritz ^{1,10,15}✉



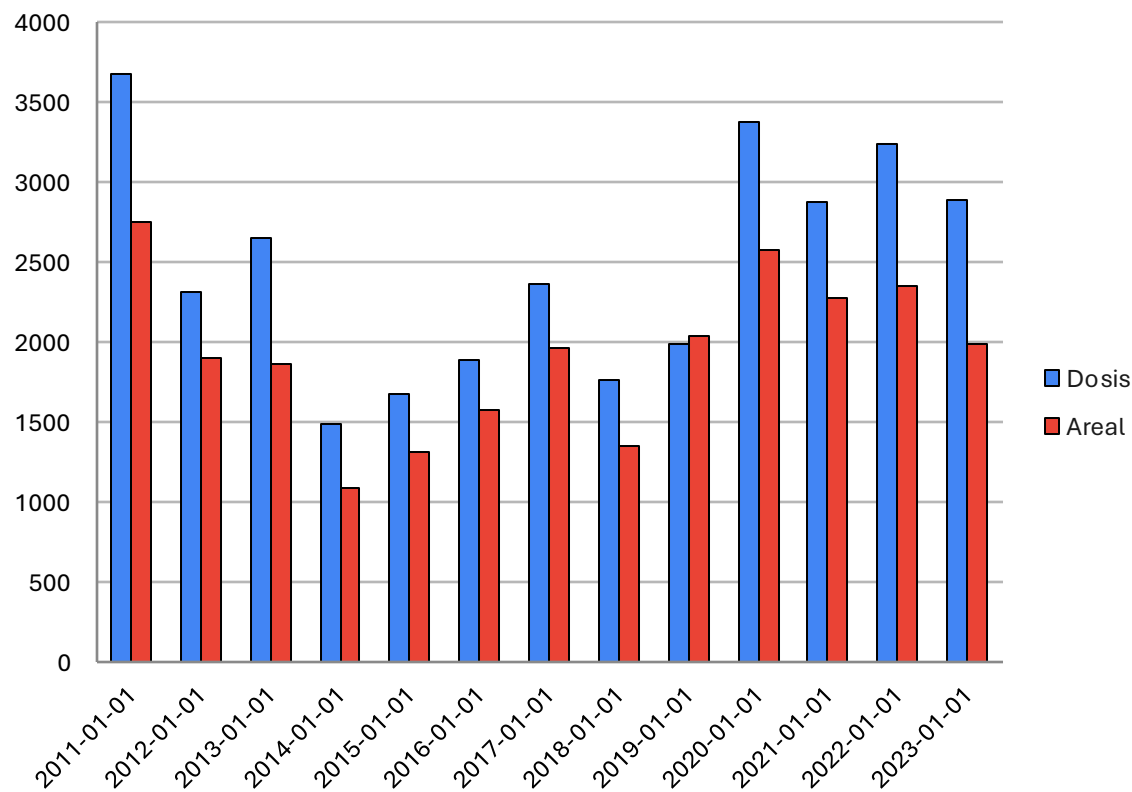
Parkinson-relevante pesticider på Ærø

2,4-D	Herbicide
Bromoxynil	Herbicide
Diquat dibromide	Herbicide
Ethephon	Væksregulering
Glyphosate	Herbicide
Maneb	Fungicide
MCPA	Herbicide
Propyzamide	Herbicide
Sulfur	Fungicide

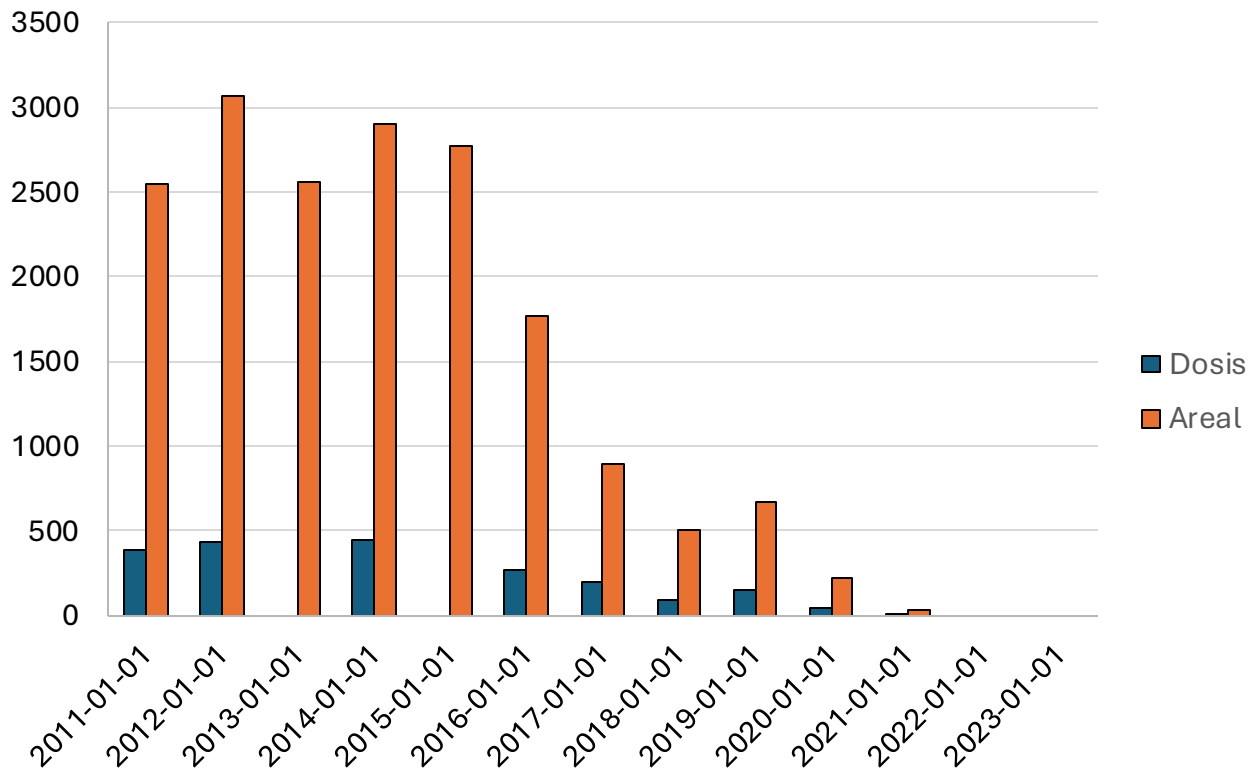


Parkinson-relevante pesticider på Ærø

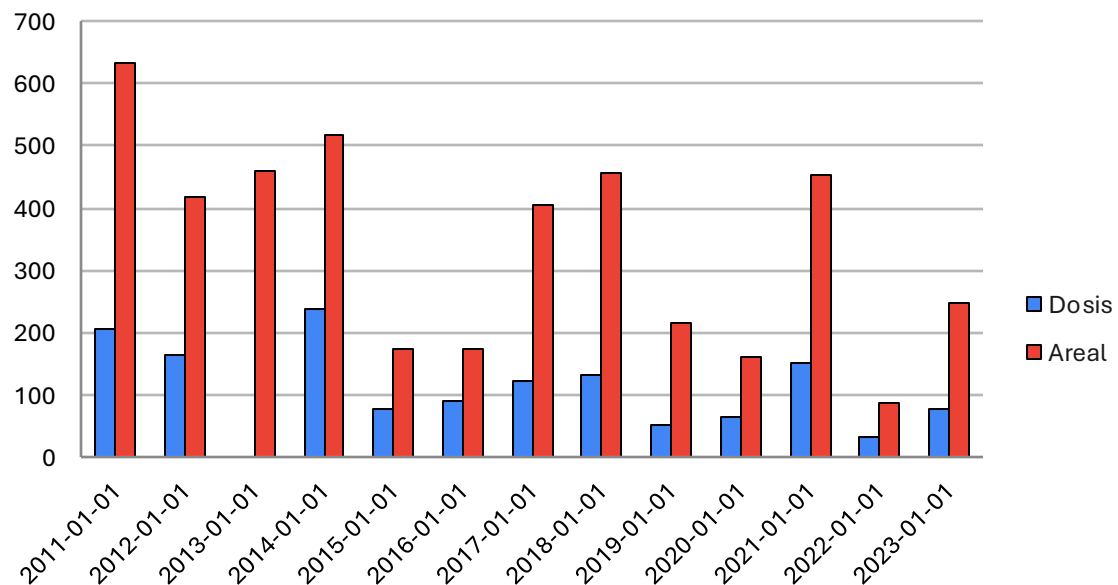
Glyphosat



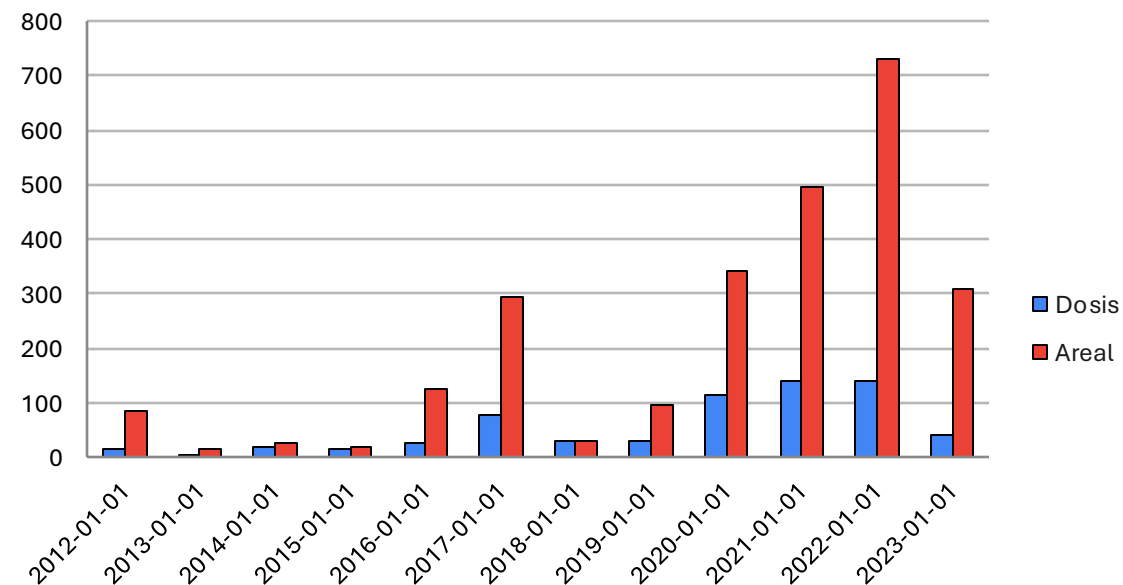
Bromoxynil



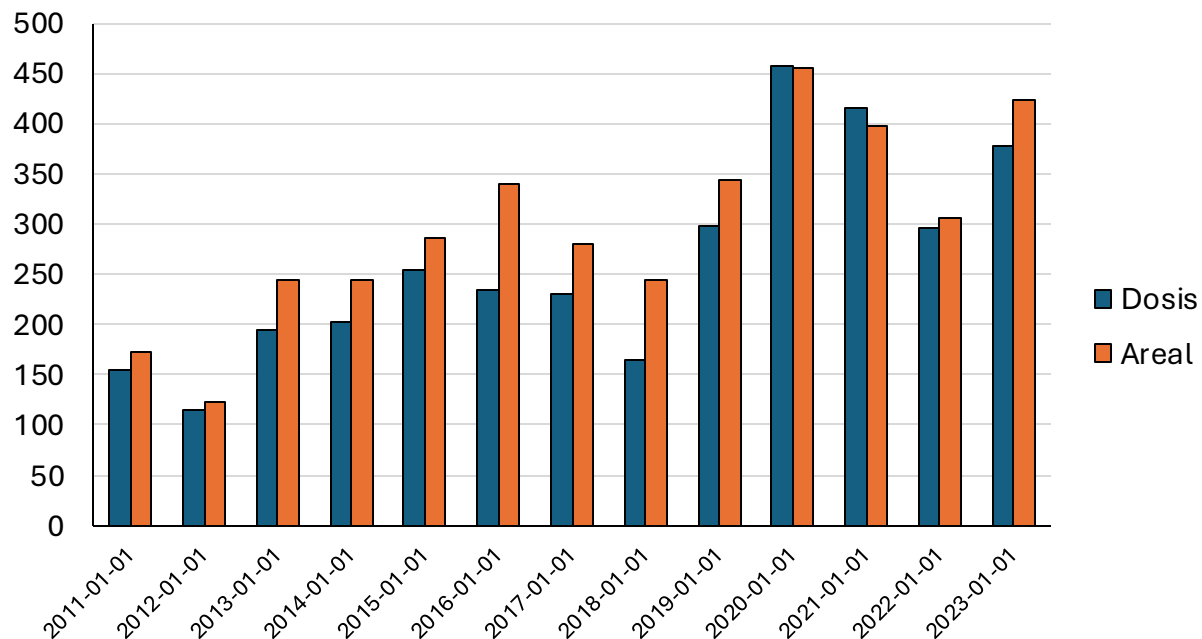
MCPA



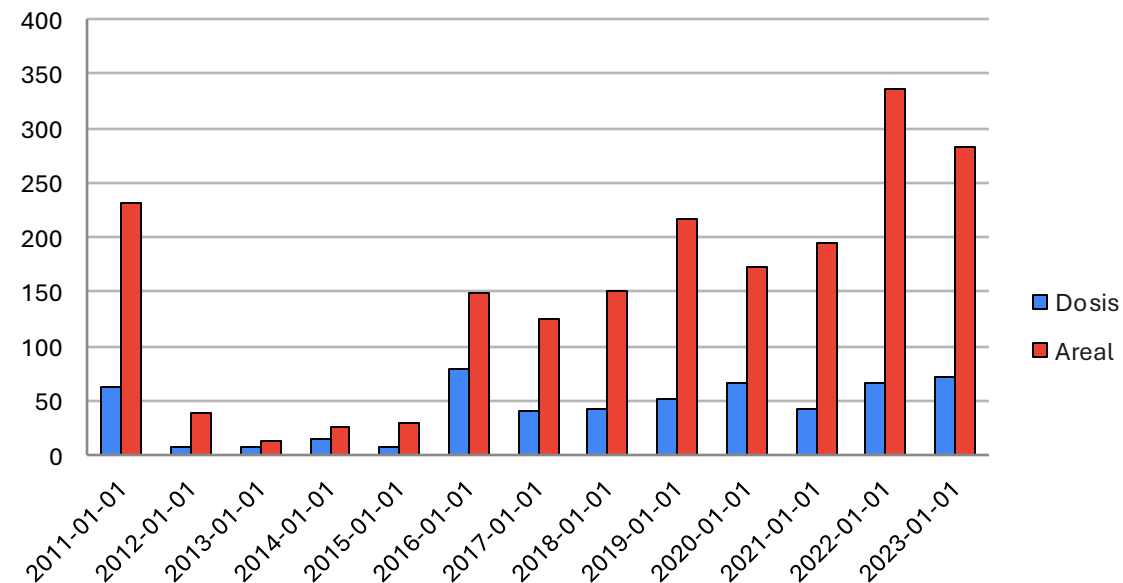
Ethephon



Propyzamide

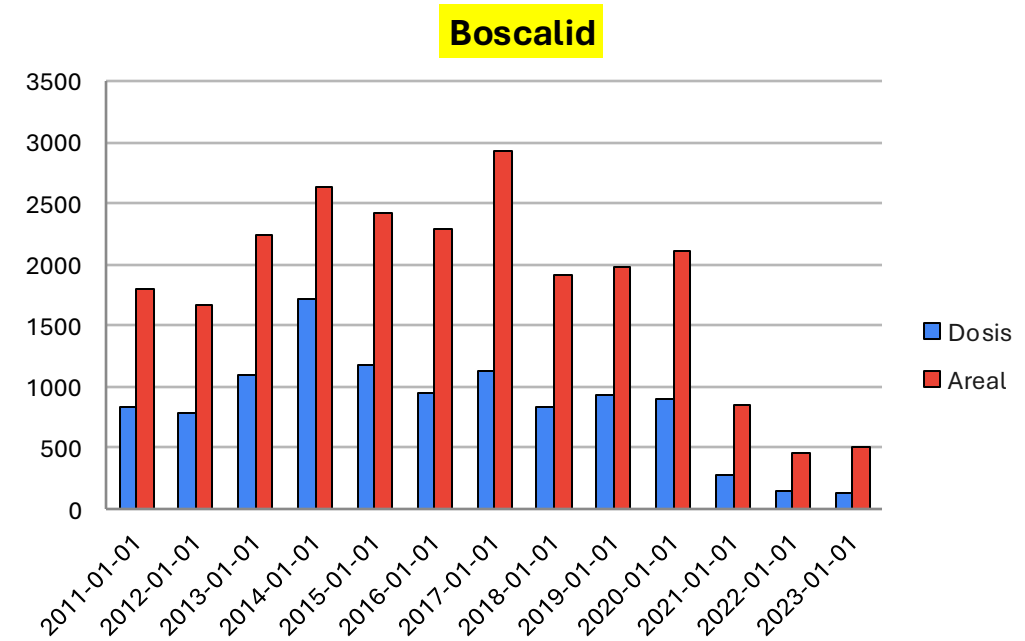
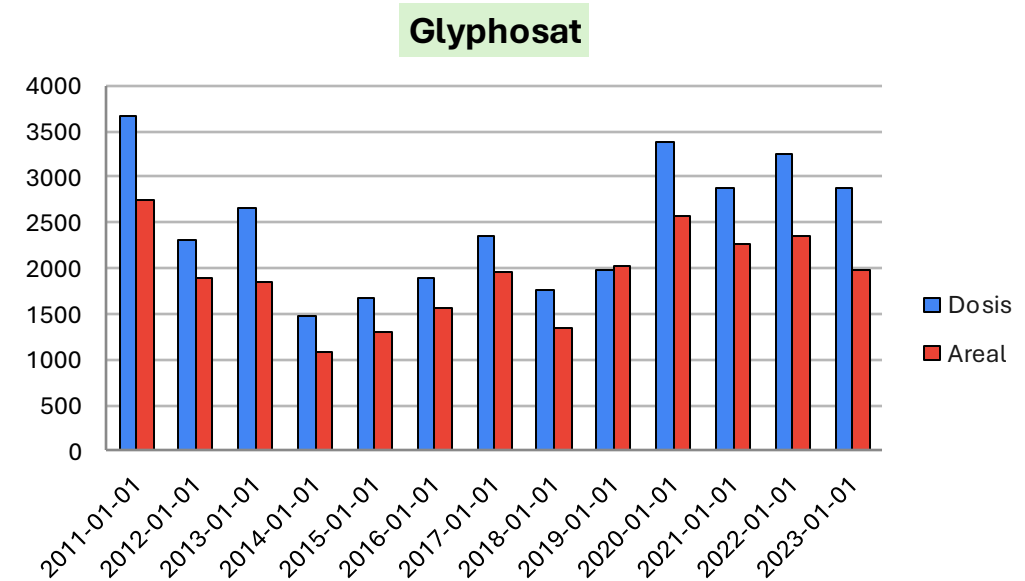
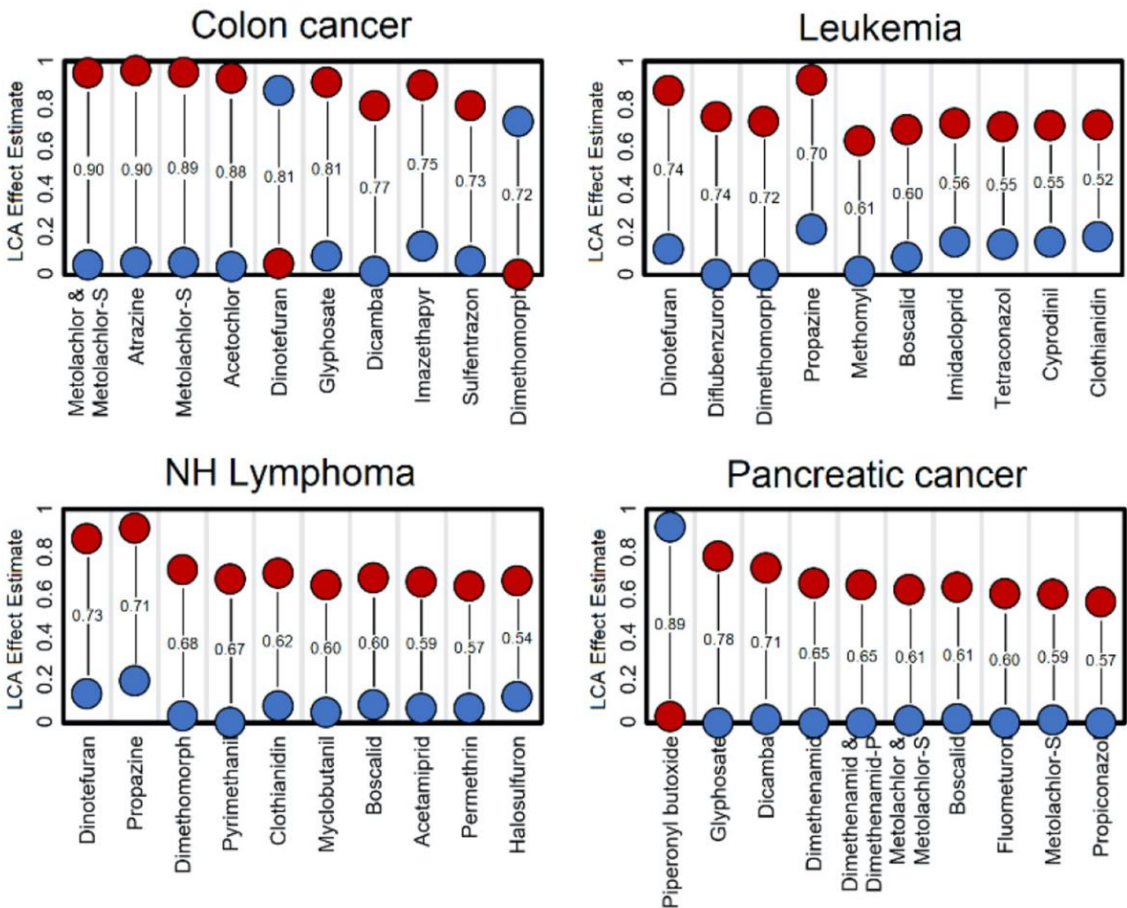


2,4-D



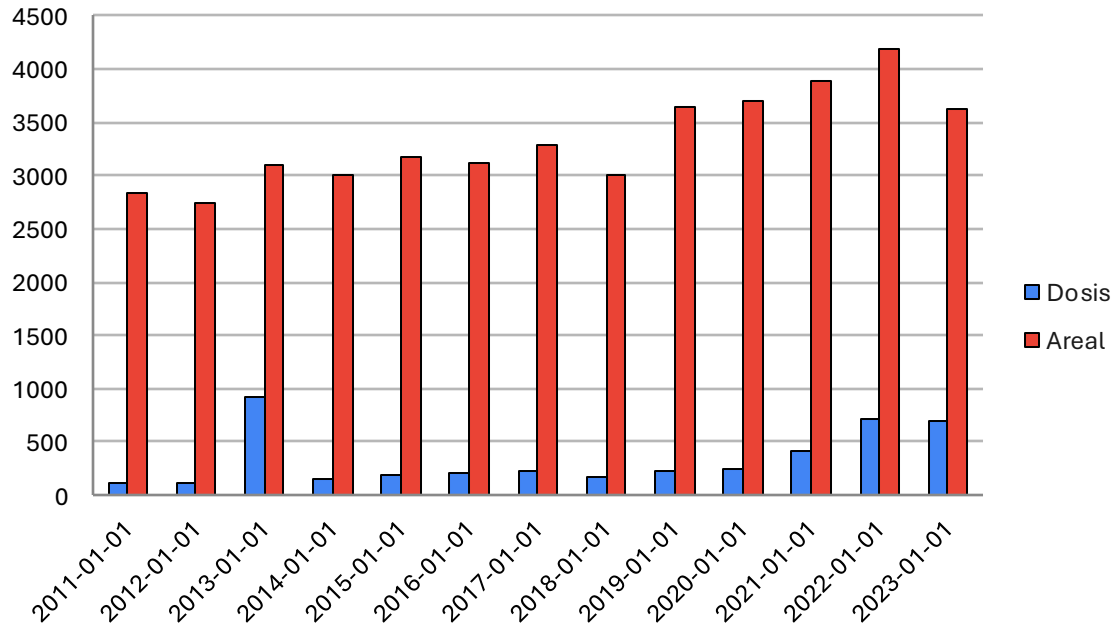
Comprehensive assessment of pesticide use patterns and increased cancer risk

Jacob Gerken, Gear Thomas Vincent, Demi Zapata, Ileana G. Barron and Isain Zapata (2024) *Front. Cancer Control Soc.* 2:1368086.

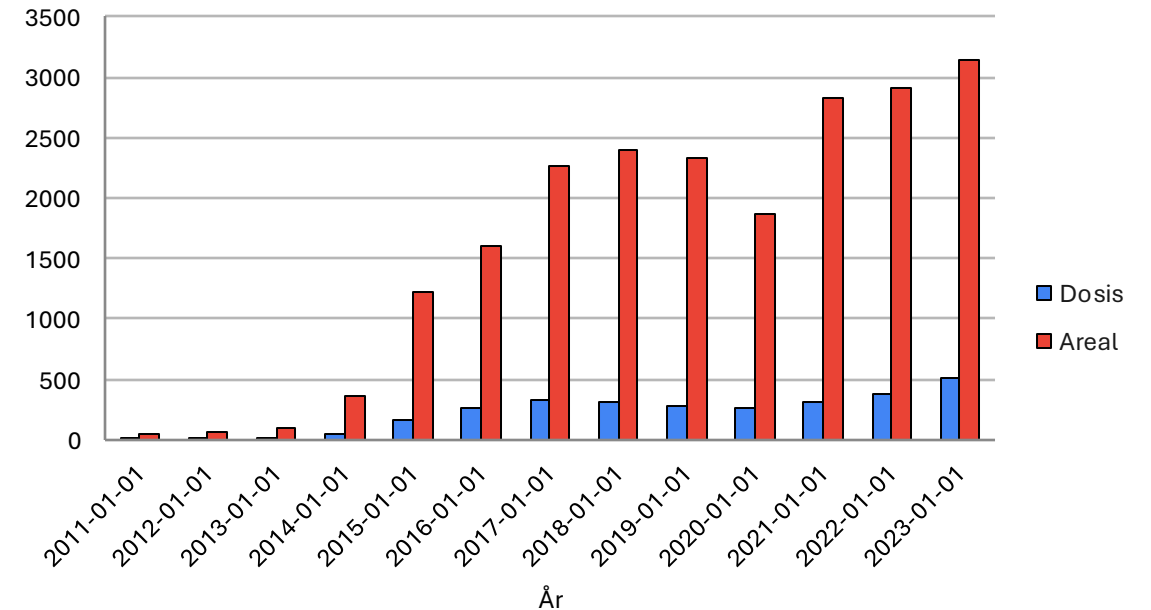


Hyppigst anvendt herbicid og insekticid

Diflufenican



Lambda-cyhalothin



Environ. fate	Ecotoxicity	Human health
High alert: Potential for particle bound transport	Moderate: Birds chronic; Fish acute and chronic; Daphnia acute and chronic; Earthworms acute	Moderate: Mammals chronic toxicity; Reproduction/development effects

Environ. fate	Ecotoxicity	Human health
Moderate: Potential for particle bound transport	High alert: Birds chronic; Fish acute and chronic; Daphnia acute and chronic; Bees acute contact and acute oral	High alert: Mammals acute toxicity, reproduction/development and neurotoxic effects

Konklusion – Ærøs pesticider 2010-2023

- Mange afgrøder sprøjtes 6 til 13 gange per år - uden varsling til beboerne
- Der er brugt > 300 forskellige pesticid produkter, som indeholder i alt 89 forskellige aktivstoffer
- Parkinson-relevante pesticider er:
2,4-D, bromoxynil, ethephon, glyphosat, MCPA, propyzamide
- Blandt kræftfremkaldende pesticider er:
boscalid, glyphosat, propricanazol
- Screening for pesticidrester i drikkevandet er helt utilstrækkeligt. Kun 15 ud af 89 anvendte aktivstoffer er på listen af screenede stoffer.

Anbefalinger til landmænd, vandværker og kommunen

- Indfør varsling inden sprøjtning til beboerne indenfor 500 m (og informer kommunen hvilket sprøjtegift der bruges)
- Stop brug af Parkinson-relevante og kræftfremkaldende pesticider
- Reducer antal sprøjtninger per afgrøde til et maksimum (f. eks. 3-4)
- Stop sprøjtning af følsomme indvindingsområder til drikkevandet. Grundvandsparker skal udpeges.
- Vandværker skal udvide screening af grundvandet og drikkevandet for nye pesticider
- Stop sprøjtning i Natura-2000 områder og strandbeskyttelseszonen
- Brug trepart aftalen til halvering af pesticid-forbruget inden 2030



Pesticides and Parkinson's Disease. A well-established causal relationship. Measures to protect all citizens.

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Editor

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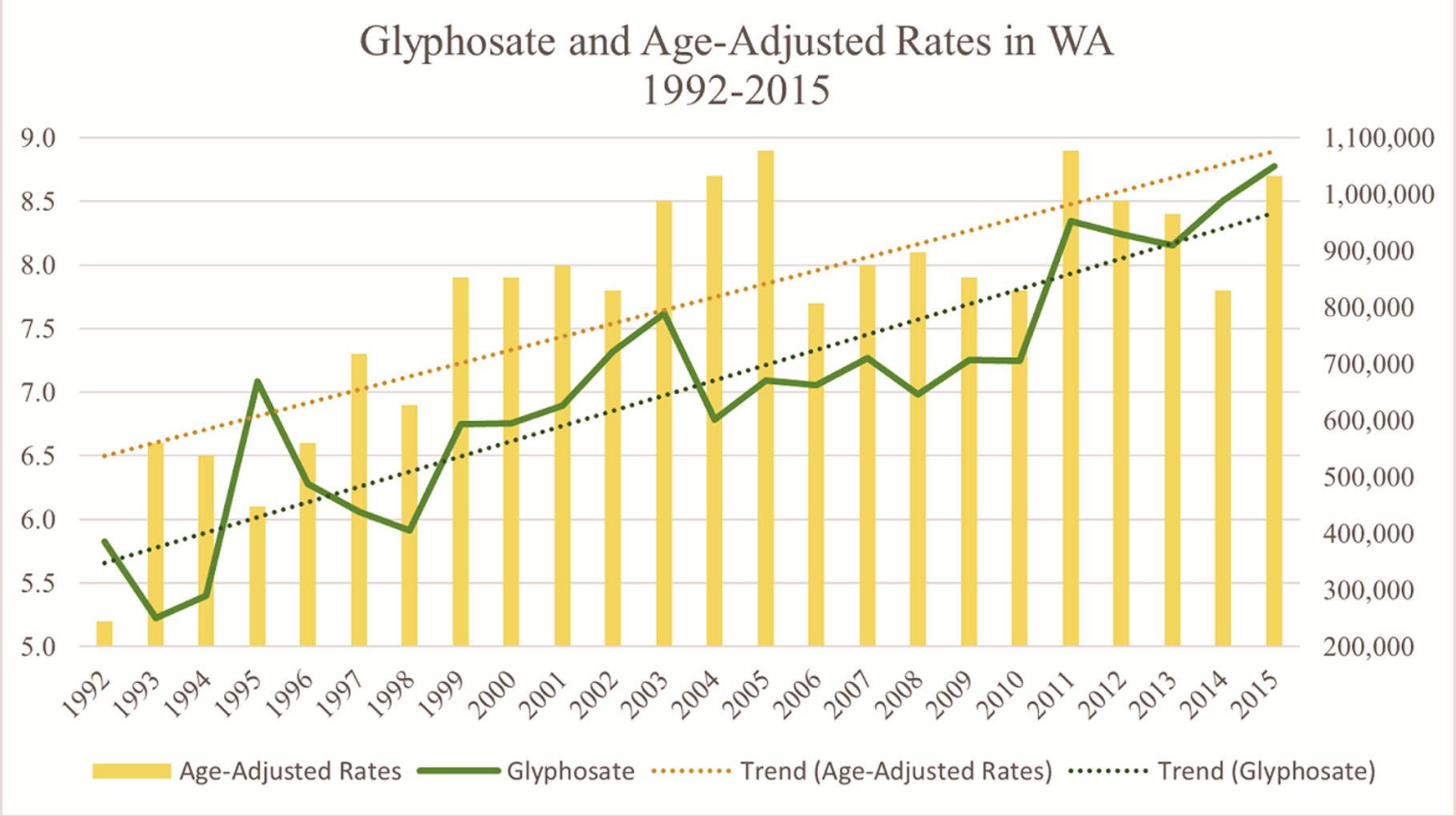


July 25, 2019 - Montréal

We encourage the parliamentary committee to intervene at a provincial level by providing the following suggestions:

- Prohibit the use of pesticides that are linked to Parkinson's disease or are capable of inducing neurodevelopmental toxicity.
- Support farmers in transitioning to organic farming practices by offering significant financial incentives.
- Restrict the use of pesticides within a 2 km radius of residences, buildings and public roads.
- Require that a public announcement be made before pesticides are to be applied in spreading areas, in order to minimize secondary exposures. These announcements should be followed by information campaigns that include strategies to protect children and residences, such as closing windows and shutting off air conditioning systems, as well as banning children from playing outside during or after application.
- Update the pesticide standards and guidelines for drinking water and modernize the Drinking Water Regulation to include all pesticides.

Glyphosate application and premature death by Parkinson’s Disease (< 74 years) in Washington State



Nøgletal fra Danmarks statistik (og Dansk Parkinsonforening)

Salg af receptpligtig medicin (eksperimentel statistik) efter nøgletal, medicintype og tid							
Enhed: Pr. 100.000 personer							
		2016	2017	2018	2019	2020	2021
Personer	N04 Anti-parkinson midler	690	704	725	764	802	839

Salg af receptpligtig medicin (eksperimentel statistik) efter nøgletal, medicintype, område og tid								
Enhed: Antal								
			2016	2017	2018	2019	2020	2021
Personer	N04 Anti-parkinson midler	Ærø	..	69	63	55	..	66

2021	66	Parkinsonpatienter på Ærø		12000	Parkinsonpatienter i DK	
	2024	Folkepensionister på Ærø		1077000	Folkepensionister i DK	
	3,261	% prævalens		1,1142	% prævalens	

Landmænd overtræder regler med pesticider

4 ud af 10 danske landbrugere overtræder reglerne for brugen af pesticider. Det viser tal fra Miljøministeriet.

12. september 2024

Landbrugsstyrelsen udførte sidste år pesticidkontrol ved 612 landbrugere, hvor af cirka 40 procent overtræder reglerne. Det viser tal, [som Politiken](#) har modtaget fra Miljøministeriet.

Regelbrud, der sker år efter år. Maria Reumert Gjerding, præsident i Danmarks Naturfredningsforening, kalder antallet af overtrædelser -chokerende højt.

- Det er jo fuldstændig uacceptabelt og dybt, dybt bekymrende, at man finder så mange lovovertrædelser i forhold til pesticider, siger hun.

Det er et politisk mål at styrke kontrollen for brugen af pesticider og mindske antallet af overtrædelse, hvilket konkret Sprøjtemiddelsstrategien fra 2022 skal være økonomisk garant for.

- Vi har brug for en skærpet kontrol, så myndighederne i højere grad både holder øje med, hvad landmændene er i besiddelse af, og hvad der faktisk foregår ude på markerne, siger præsident i foreningen Maria Reumert Gjerding.