Sixty Years of Pesticide Usage Surveys

Changes in arable crops over time

Original thinking... applied

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PUS surveys: 1965 - 2025

- Surveys funded by crop protection industry and managed by HSE
- Data used for regulatory purposes and PLI
- Respond to queries from Government, academia, industry & the public
- Surveys are voluntary but still achieve a 70-80% response rate
- Representative, stratified sample based on June Survey data

PUS surveys – data collected:

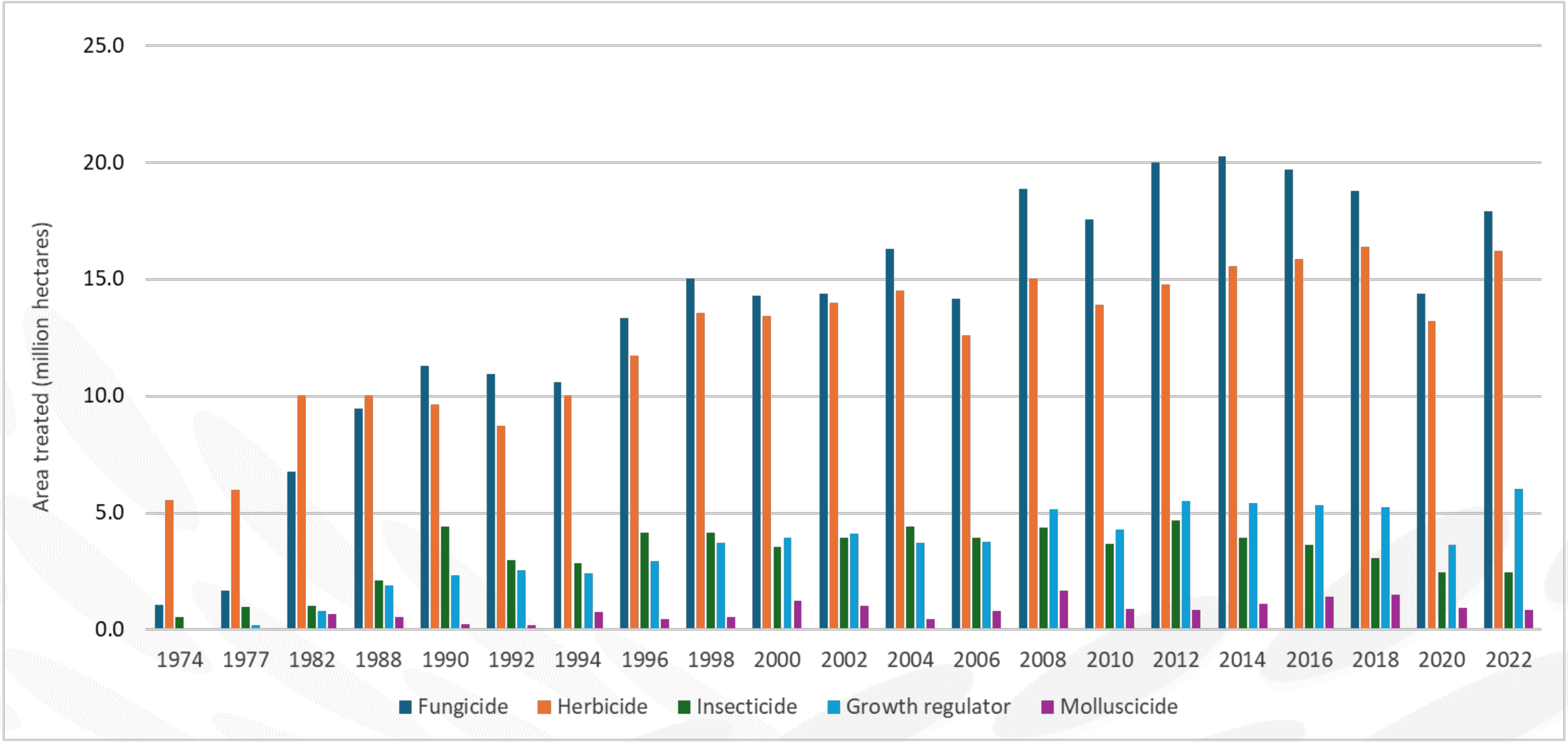
- All usage - conventional pesticides; biopesticides & living biocontrol organisms; adjuvants
- Products, dates, rates and methods of application
- Tank mixing
- Water volumes (where available)
- Use of crop covers (selected surveys)
- Use of growing media (selected surveys)
- Use of pollinators (selected surveys)

Range of surveys currently conducted:

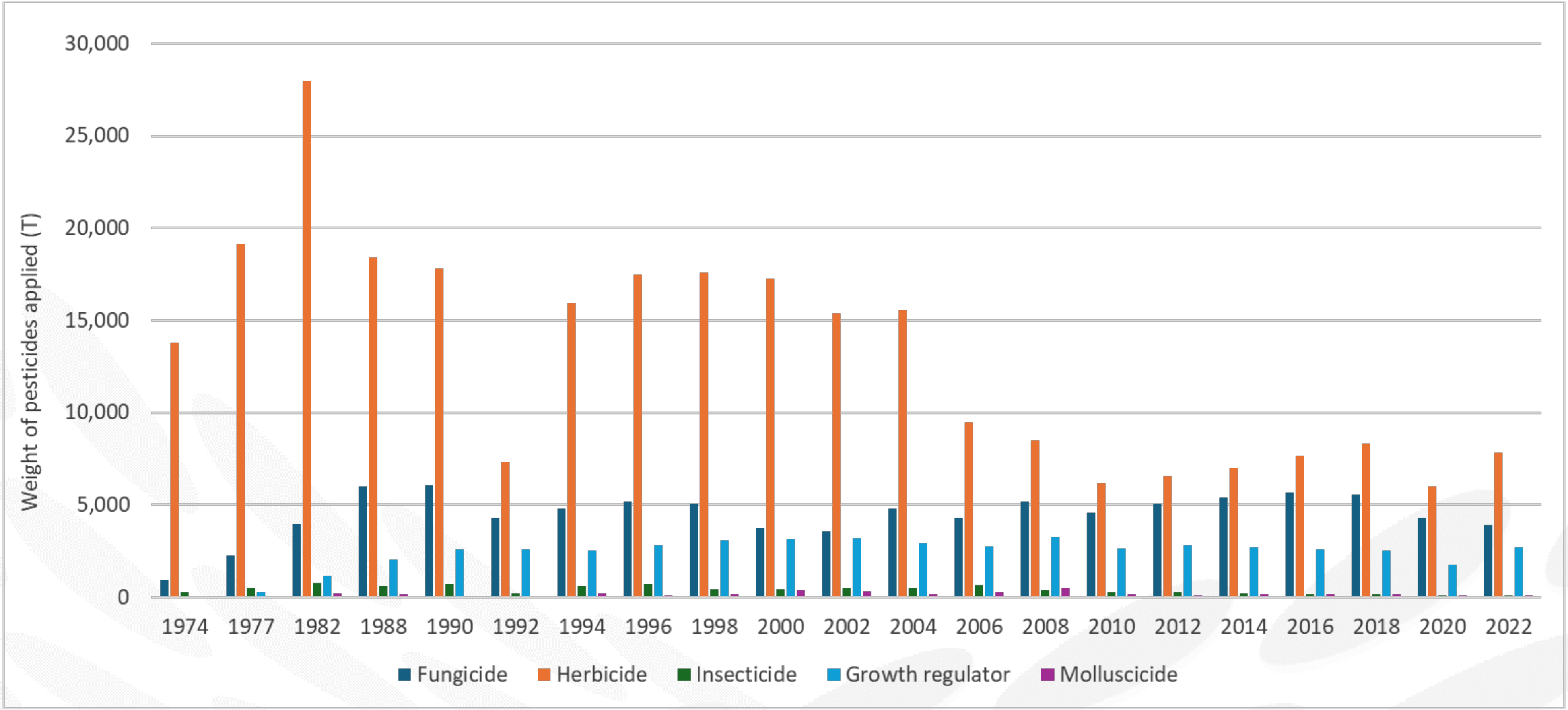
Surveyed Crops	Number of Farms	% Area Grown
Arable	1,038	5
Grassland & Fodder	627 (905)	9 (2)
Edible Protected	192	50
Outdoor Vegetables	651	28
Soft Fruit	297	37
Orchards	282	32

Original thinking... applied

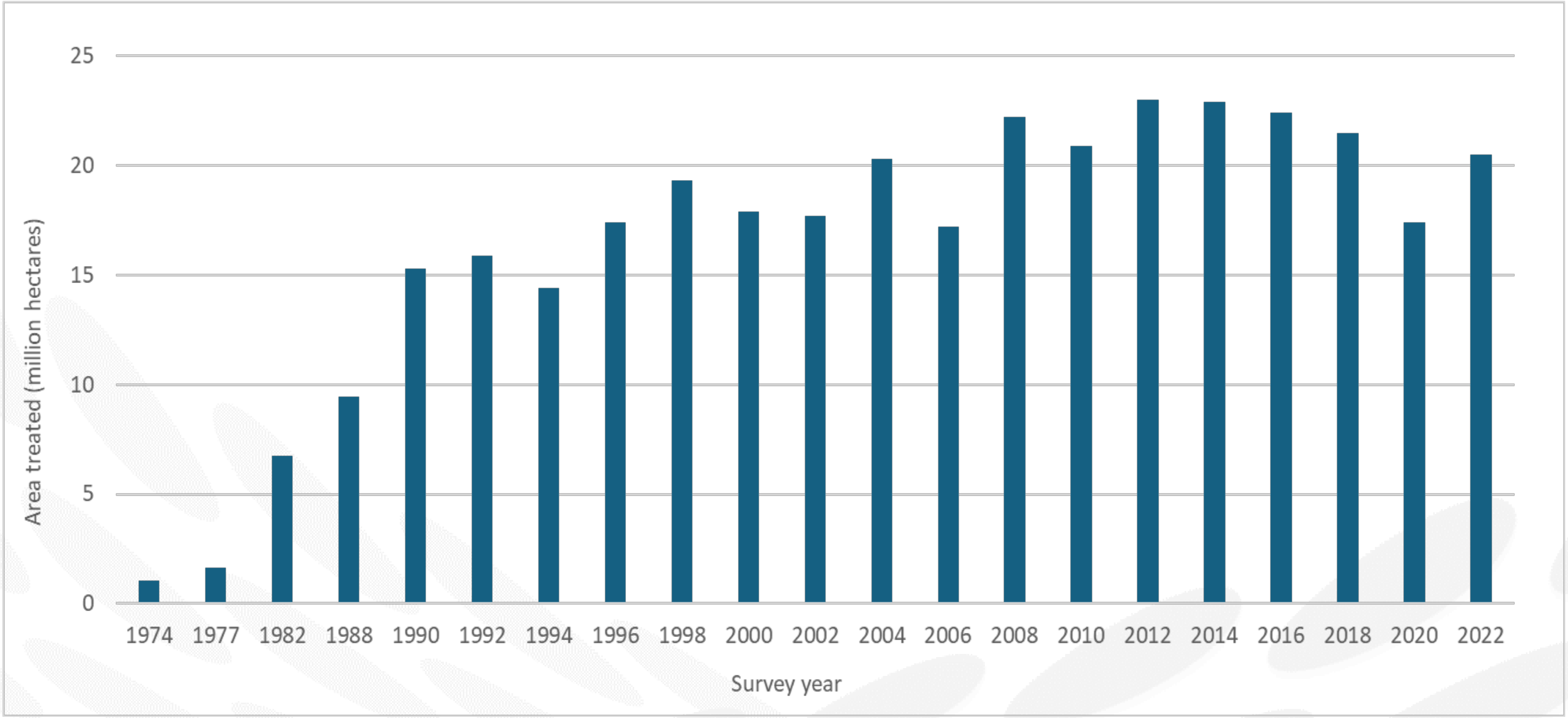
Treated areas of arable crops, 1974 - 2022



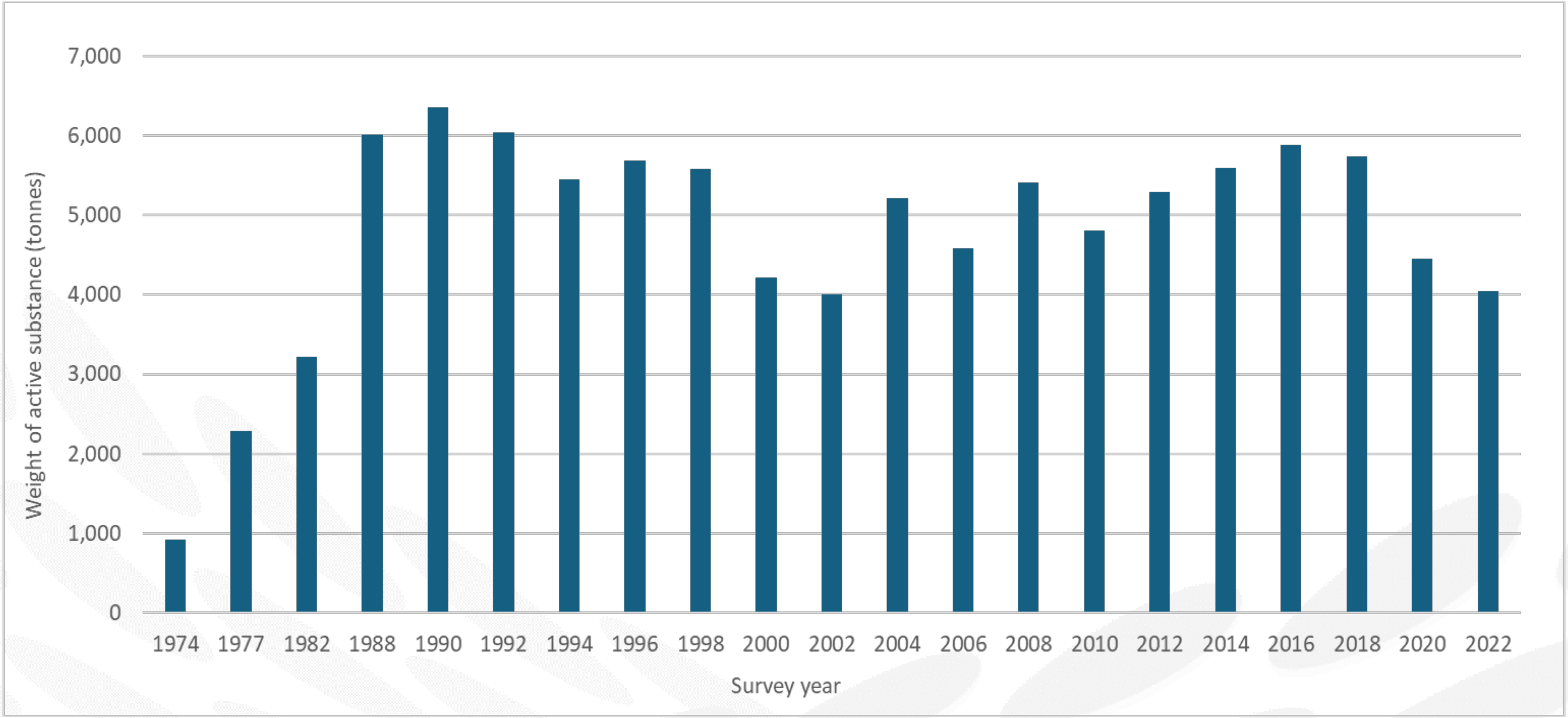
Weights applied to arable crops, 1974 - 2022



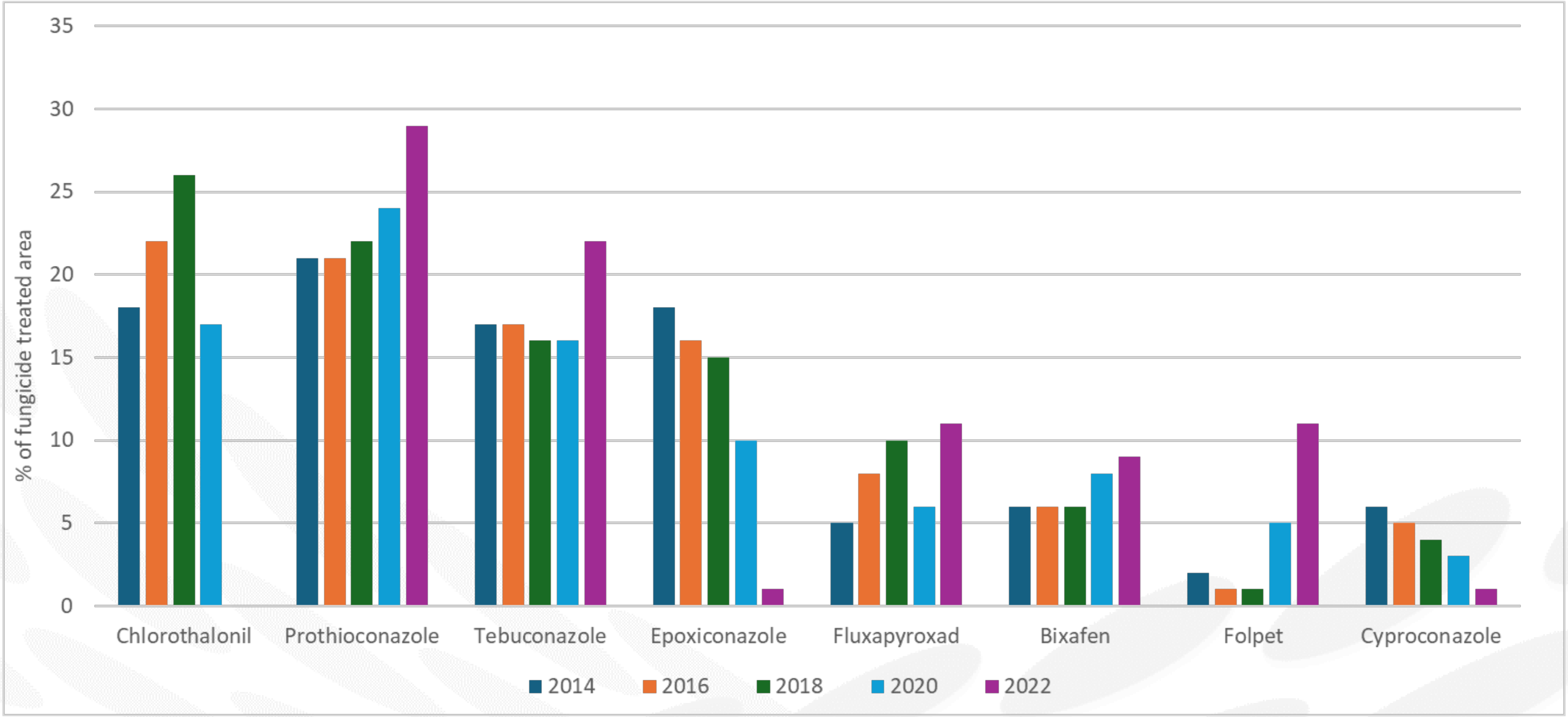
Fungicide usage – arable crops, area treated



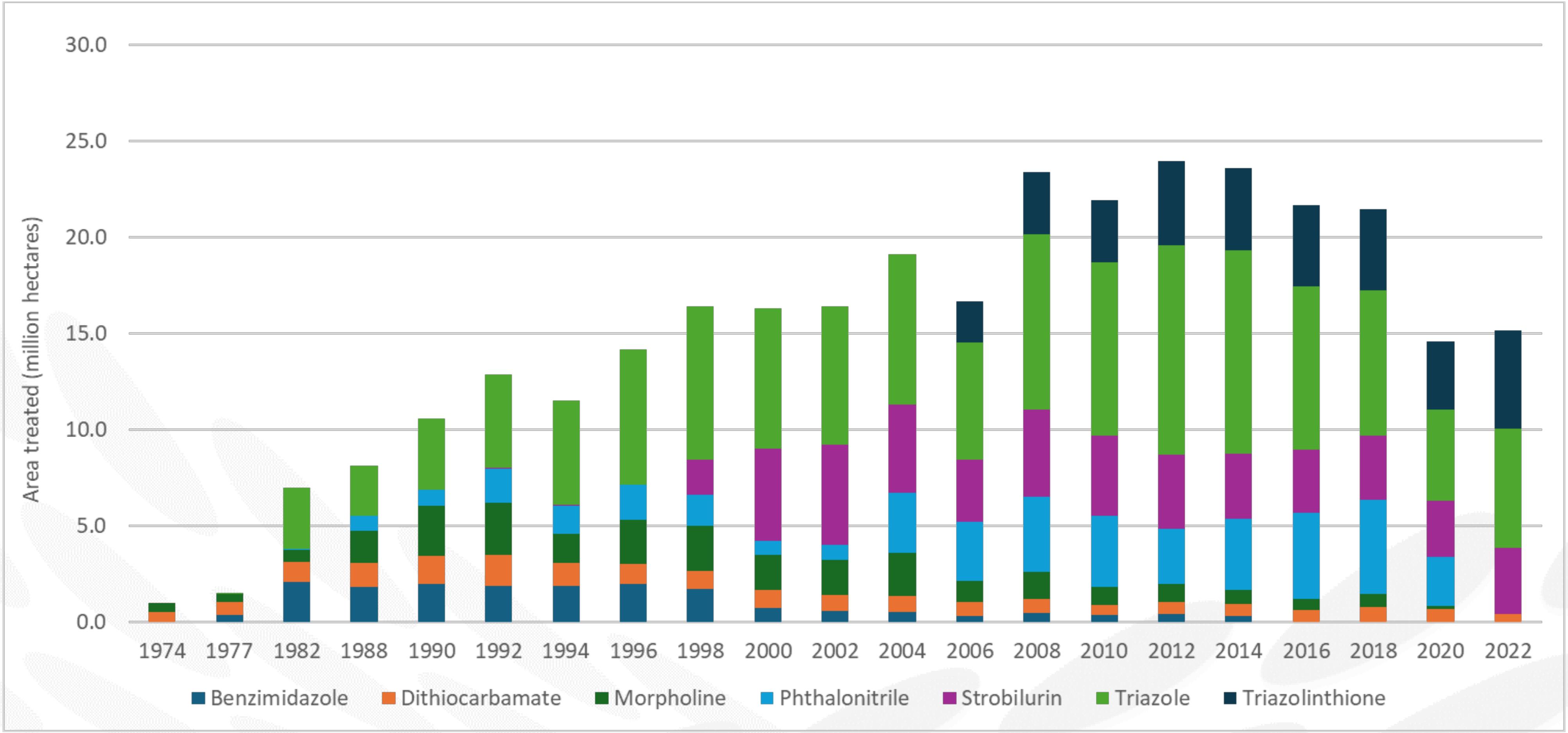
Fungicide usage – arable crops, weight applied



Fungicide usage – principal active substances

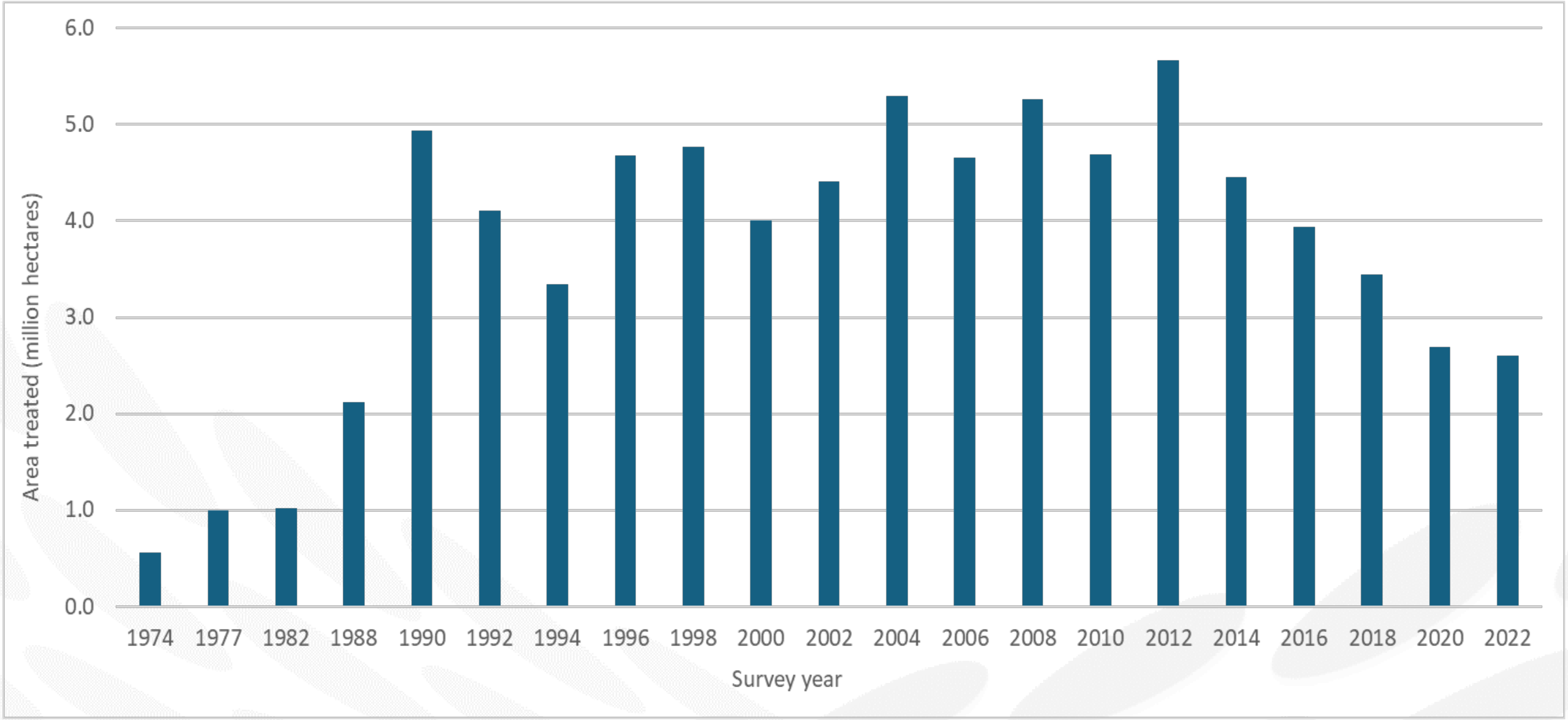


Fungicide usage – major chemtypes, area treated

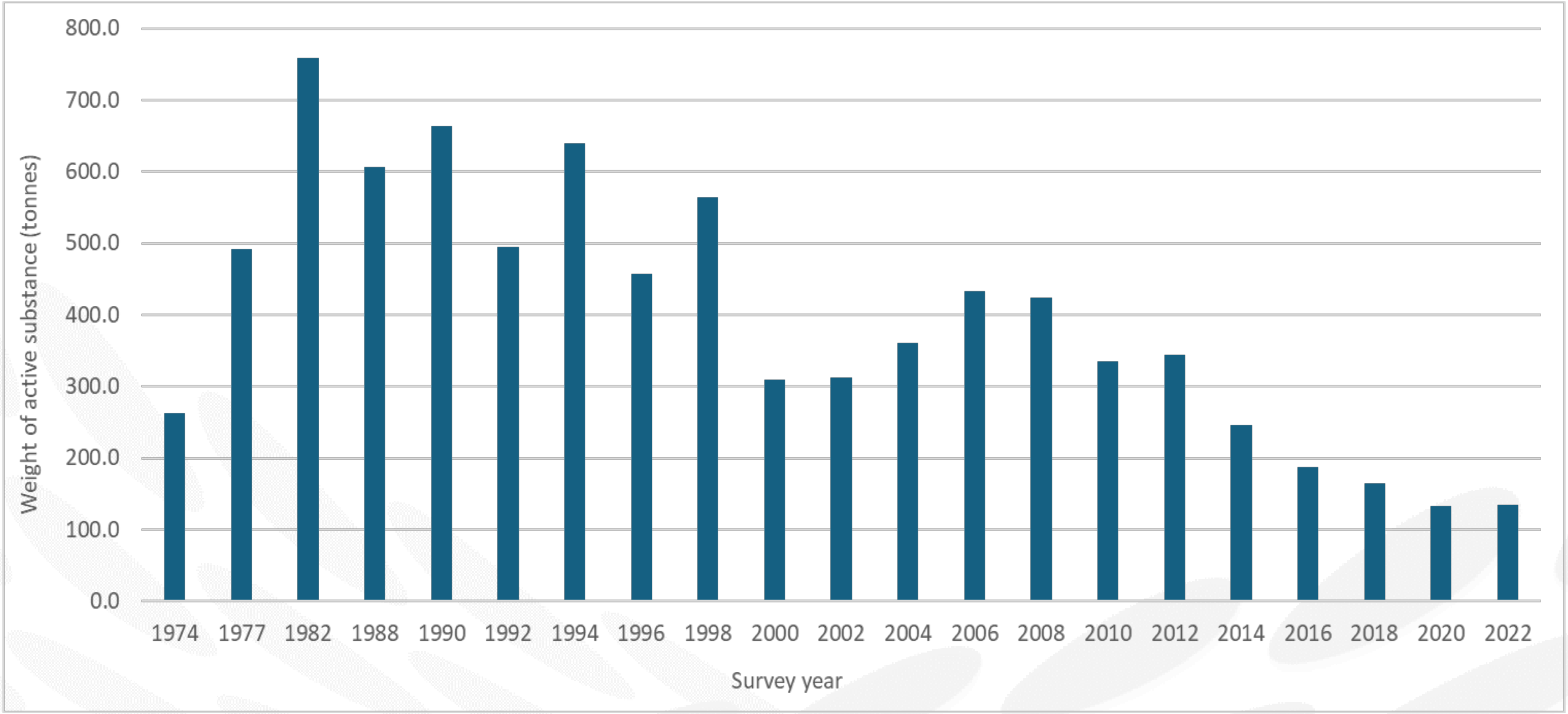


Original thinking... applied

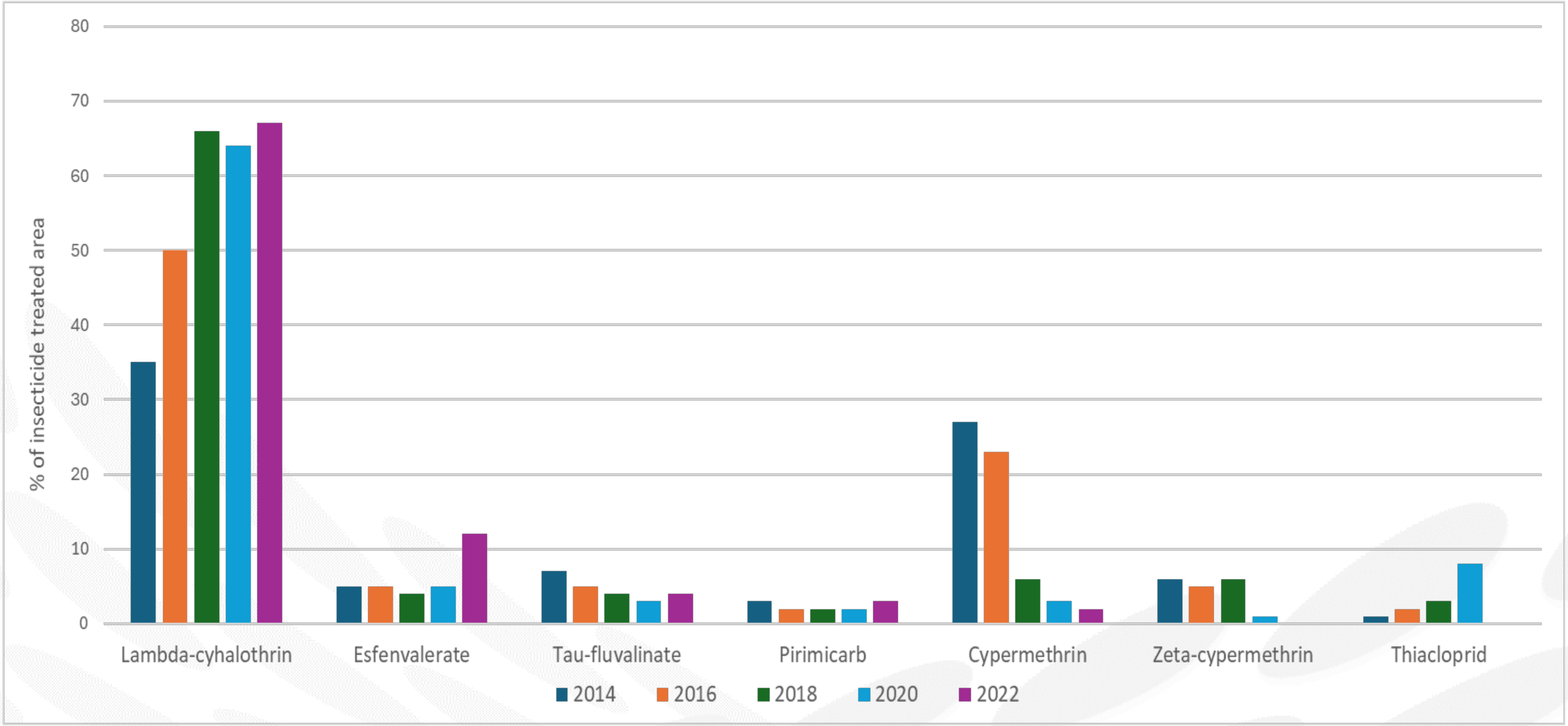
Insecticide usage – arable crops, area treated



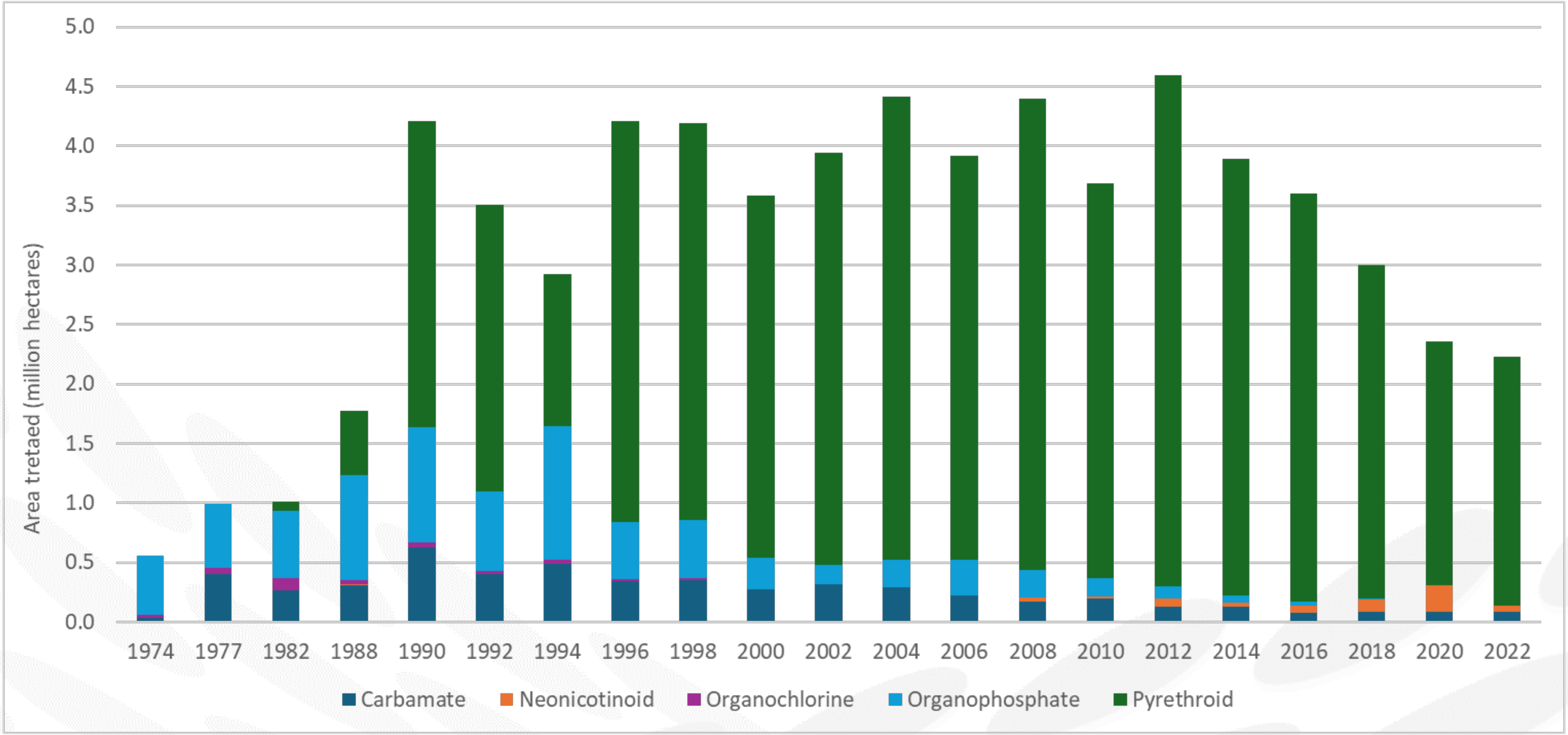
Insecticide usage – arable crops, weight applied



Insecticide usage -principal active substances



Insecticide usage – major chemtypes, area treated



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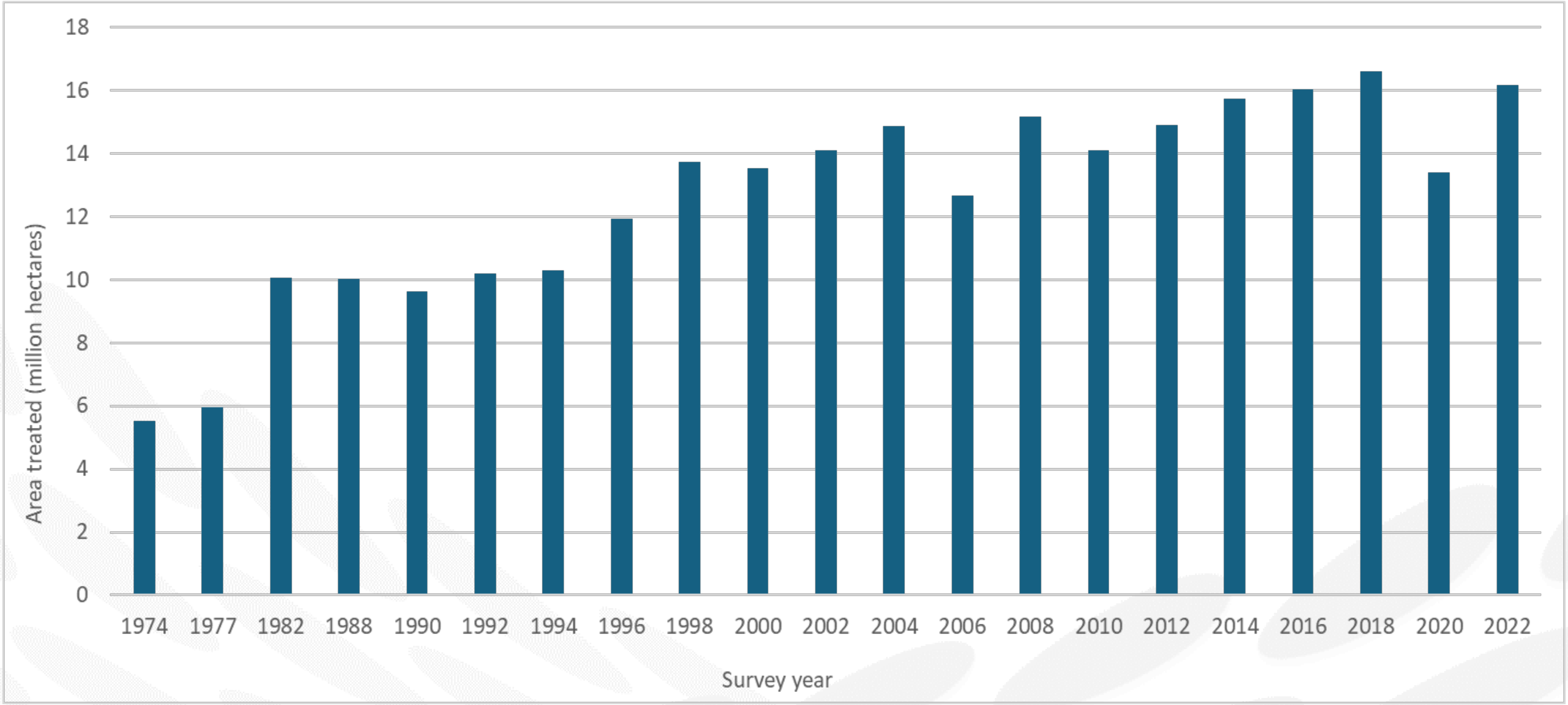
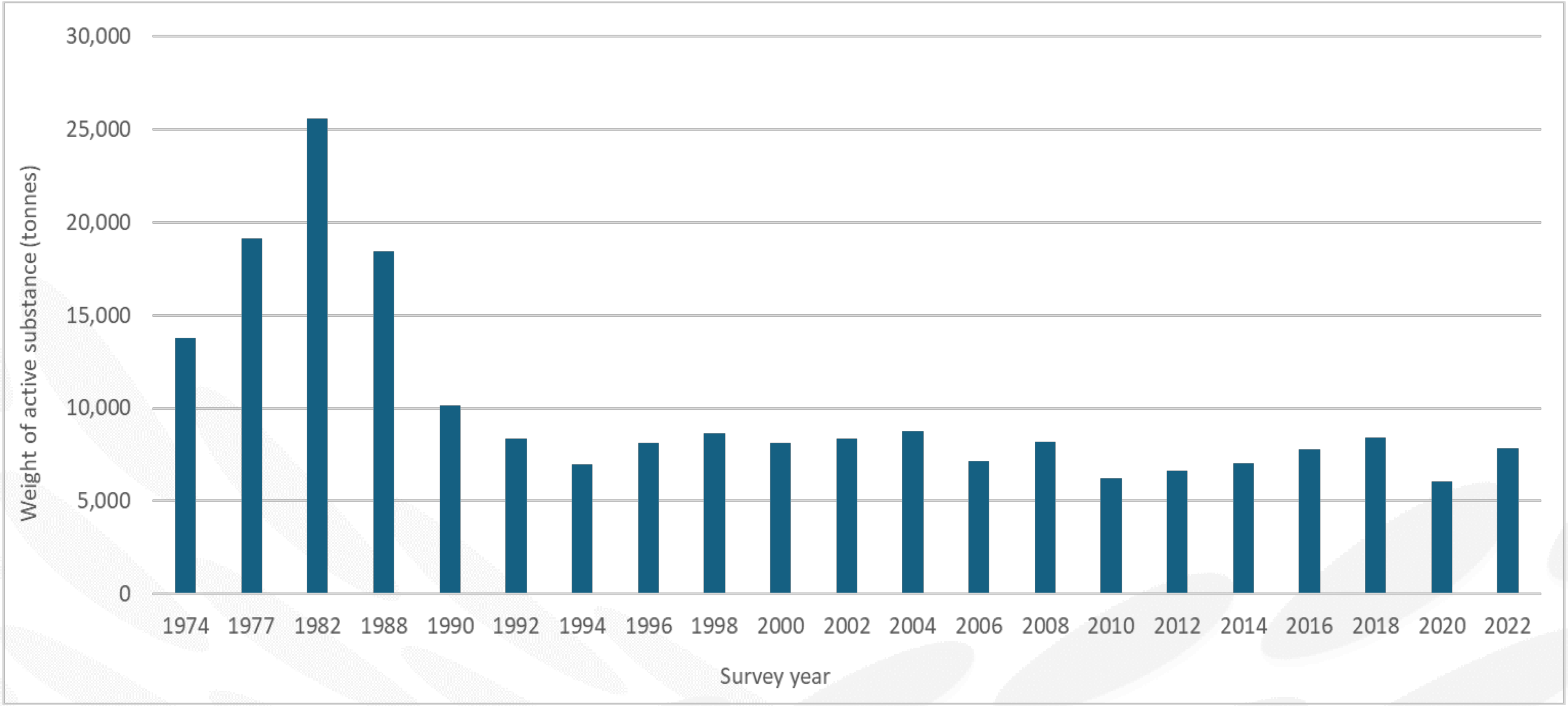
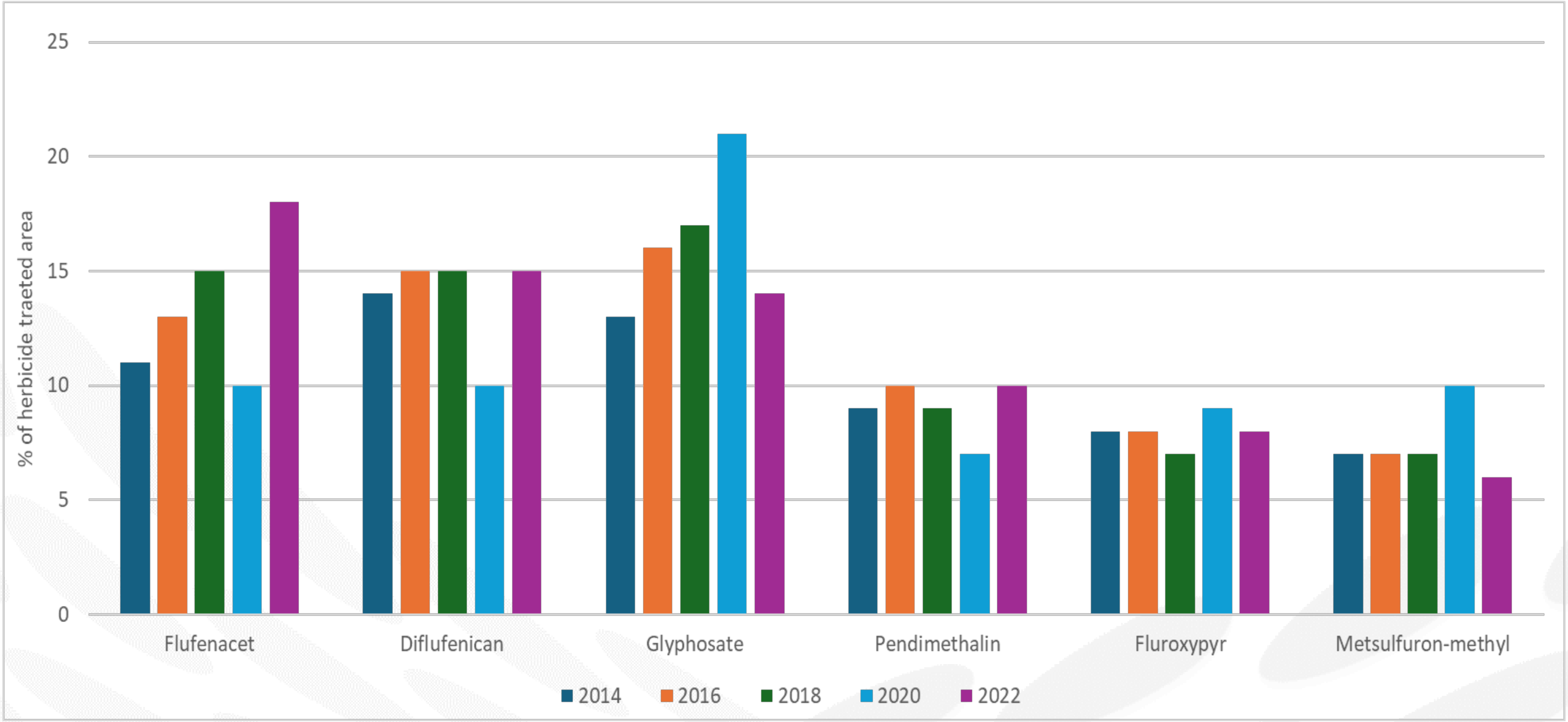
Herbicide Usage – arable crops, area treated



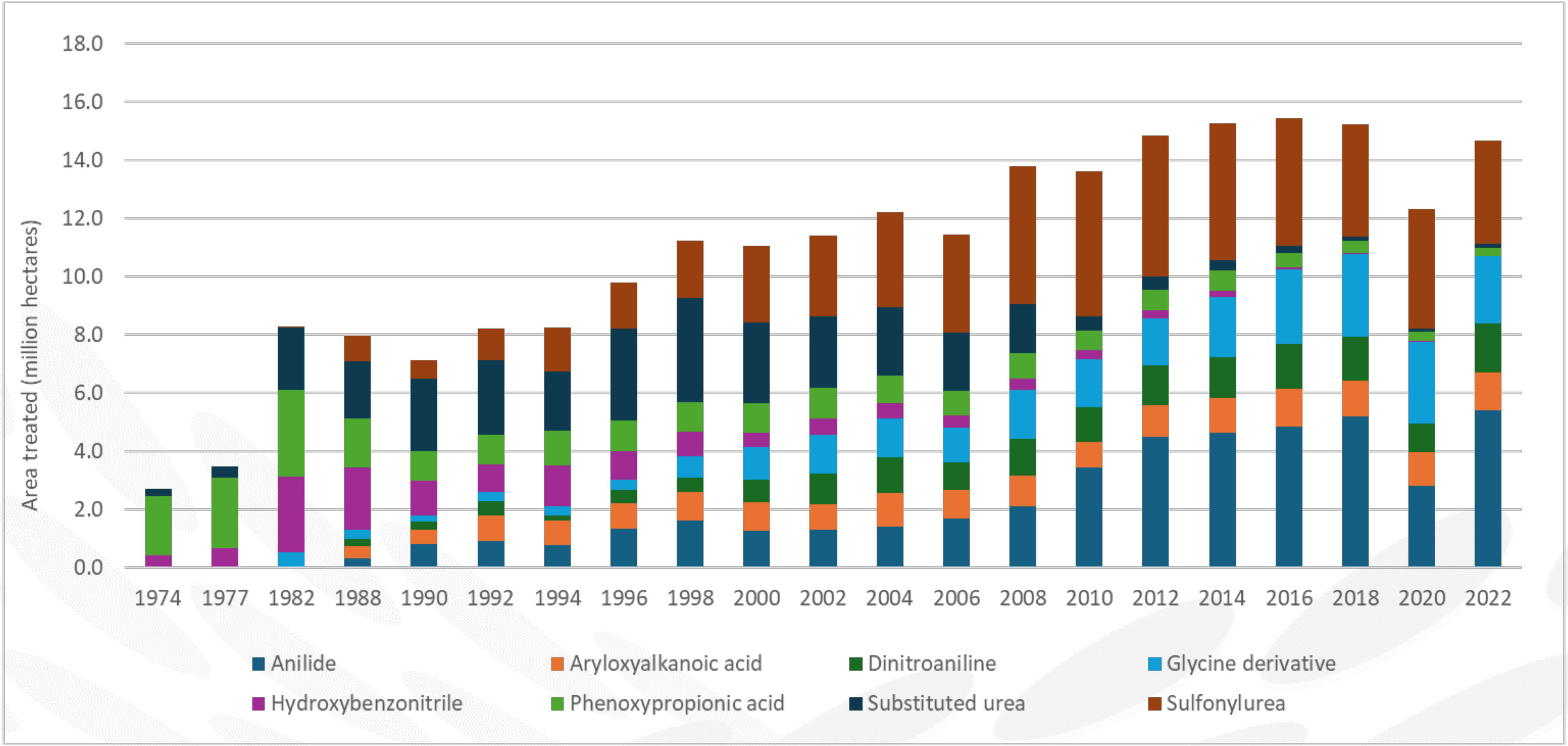
Herbicide usage – arable crops, weight applied



Herbicide usage – principal active substances



Herbicide usage – major chemtypes, area treated



UK Pesticide Load Indicator: story so far…

Started in 2019 as a research tool, funded by Defra, in partnership with the University of Hertfordshire

- Builds on Danish PLI
- Combines information on pesticide usage and pesticide properties
- Create indicators of various pesticide 'load' measures
- Assess trends in environmental effects
- Generate information to help track and understand policy impact

Lewis, K., Rainford, J., Tzilivakis, J. and Garthwaite, D. (2021) Application of the Danish Pesticide Load Indicator to UK arable agriculture. Journal of Environmental Quality, 50(5), 1110-1122. DOI: 10.1002/jeq2.20262

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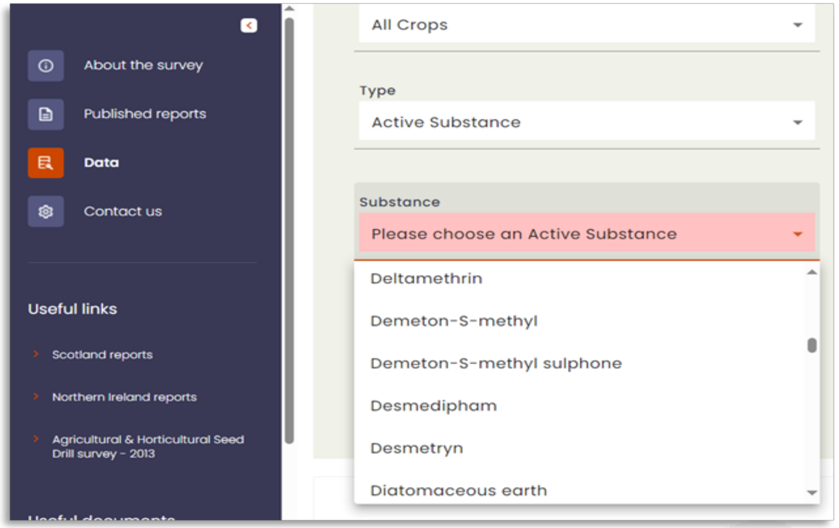
Pesticide Usage Survey

https://pusstats.fera.co.uk/home

Provides representative sample of plant protection products applied in UK

- Used to estimate national and regional statistics (area treated, mass applied)
- Rolling program including arable, outdoor vegetables, soft fruit, top fruit, grassland and fodder
- For a given crop type and year, total usage is estimated from **stratified sampling by region and farm size** + June survey totals (or other sources for devolved authorities)




Results

Export as CSV

Crops are not surveyed annually. To see which crops were surveyed in each year Click here .

Year	Survey	Region	Crop group	Active Substance	Total Area Treated (ha) 1	Total Weight Applied (kg)
2022	Arable crops	United Kingdom	All	Deltamethrin	14,604	64
2020	Arable crops	United Kingdom	All	Deltamethrin	25,492	145
2018	Arable crops	United Kingdom	All	Deltamethrin	54,112	327
2016	Arable crops	United Kingdom	All	Deltamethrin	41,846	260

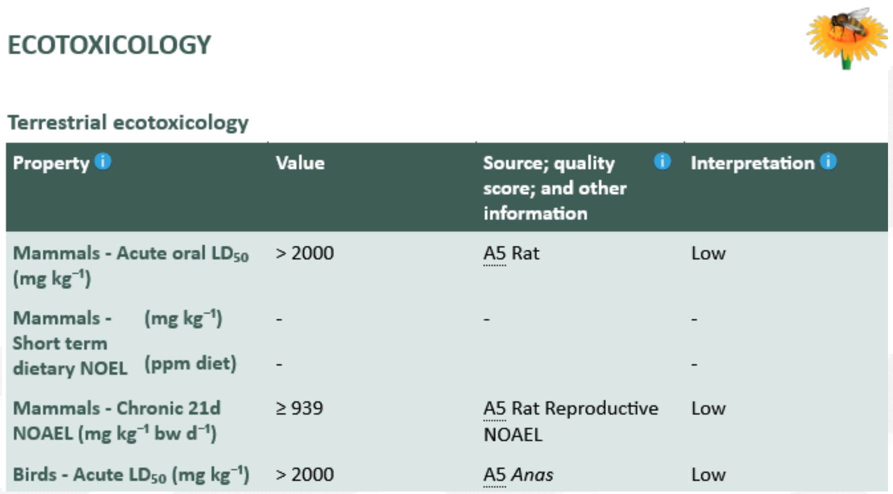
Pesticide Properties Database

For each active substance, extracted 4 measures of fate

- persistence; surface and groundwater mobility; bioaccumulation

And 16 measures of ecotoxicity

- algae, aquatic plants, aquatic invertebrates, fish, birds, earthworms, bees, mammals, and other arthropods



ECOTOXICOLOGY

Terrestrial ecotoxicology

Property		Value	Source; quality score; and other information	Interpretation
Mammals - Acute oral LD_{50} ($mg\ kg^{-1}$)		> 2000	A5 Rat	Low
Mammals - Short term dietary NOEL	($mg\ kg^{-1}$)	-	-	-
	(ppm diet)	-		-
Mammals - Chronic 21d NOAEL ($mg\ kg^{-1}\ bw\ d^{-1}$)		≥ 939	A5 Rat Reproductive NOAEL	Low
Birds - Acute LD_{50} ($mg\ kg^{-1}$)		> 2000	A5 *Anas*	Low

Pesticide Properties Database

Fate metrics:

- Persistence (soil DT_{50})
- Surface water mobility (Kfoc/Koc)
- Groundwater mobility (GUS)
- Bio-concentration factor (BCF)

Ecotoxicity metrics:

- Algae acute (EC_{50})
- Aquatic plants acute (EC_{50})
- Daphnia acute (EC_{50})
- Daphnia chronic (NOEC)
- Fish acute (EC_{50})
- Fish chronic (NOEC)
- Birds acute (LD_{50})
- Birds chronic (NOEL)
- Worms acute (LC_{50})
- Worms chronic (NOEC)
- Bees contact (LD_{50})
- Bees oral (LD_{50})
- Mammals acute (LD_{50})
- Mammals chronic (NOAEL)
- Parasitic wasps (LR_{50})
- Predatory mites (LR_{50})

Data extracted from the Pesticide Properties Database (PPDB): http://sitem.herts.ac.uk/aeru/ppdb/en/
When data are missing for substance, a protocol exists to derive the data, including using data for related substances and/or using means for the respective ‘chemical group’.

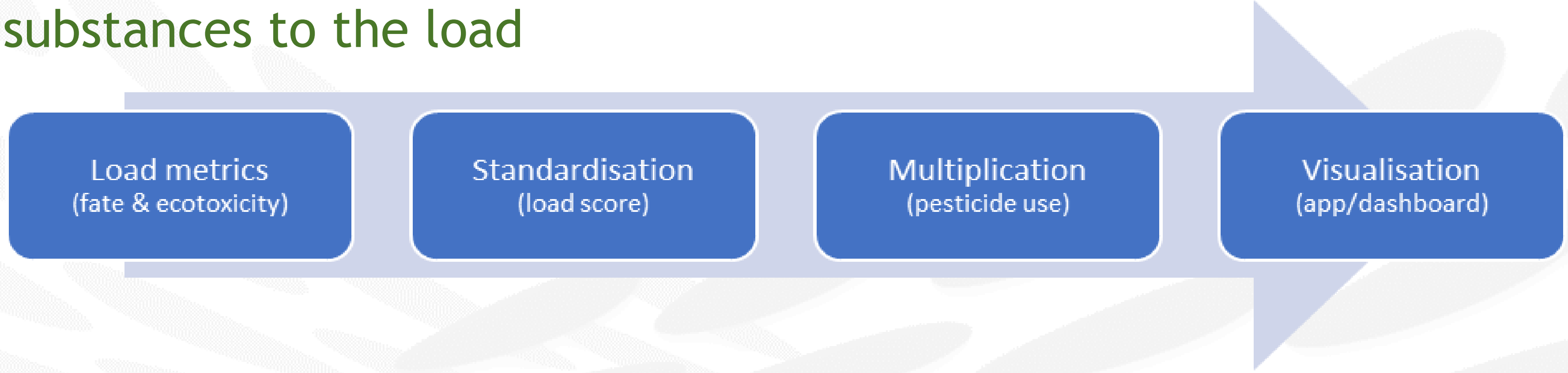
Creating the indicators

1. Scale each PPDB measure (0-1) to give a score relative to a reference substance

2. Use PUS to estimate pesticide use
   - nationally, regionally, by crop, and by pesticide type

3. Multiply the substance score by estimated pesticide use

4. Sum across all substances
   - But keep the intermediate information to visualise contribution of individual substances to the load



PLI visualisation tool – example for arable crops

Original thinking... applied

Select two years to compare

Select the reference year to benchmark against:

2010

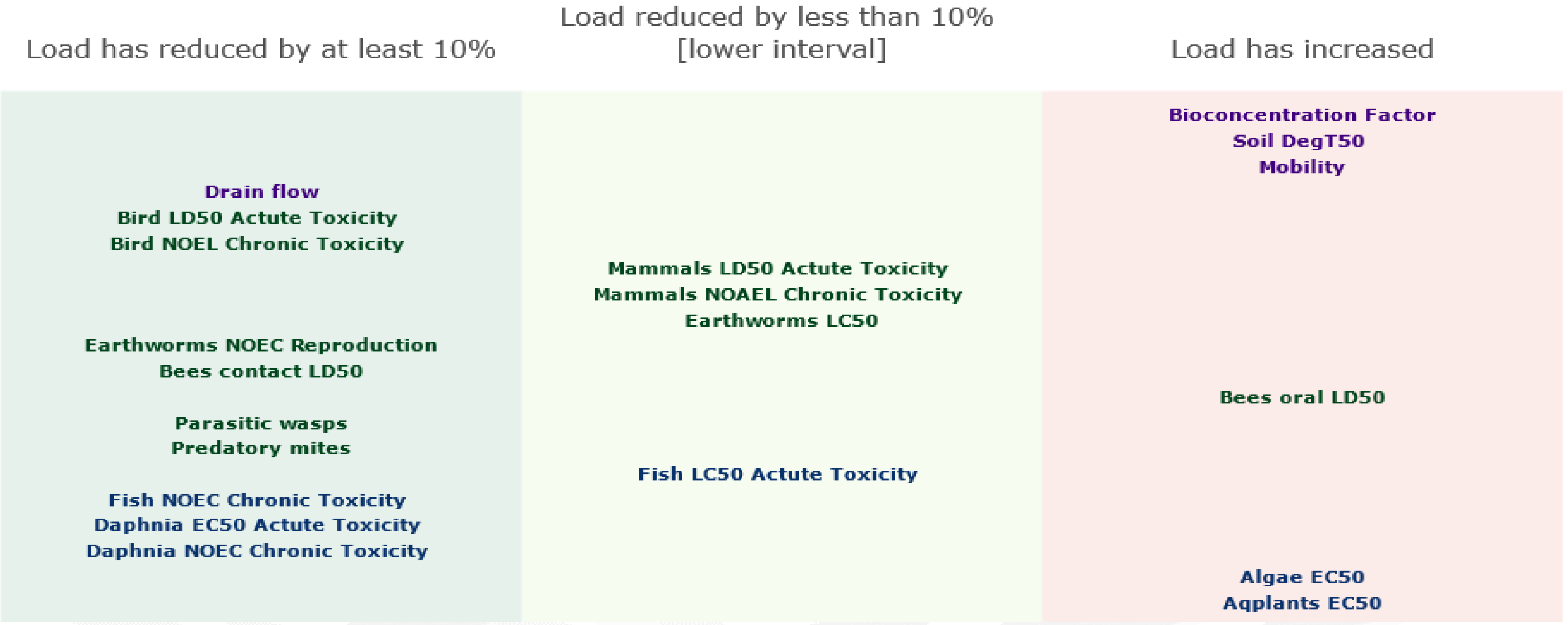
Select the target year for comparison:

2018

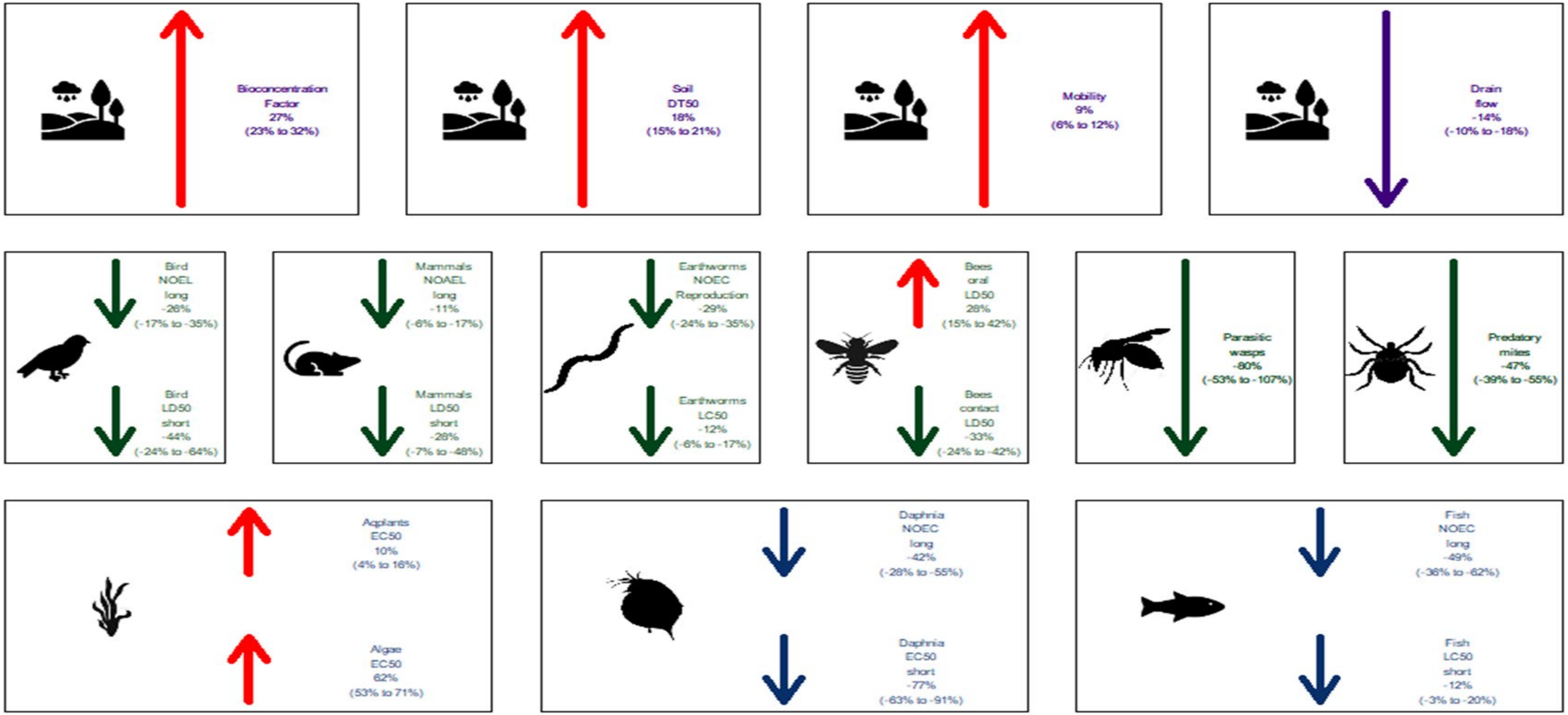
Select the target percentage:

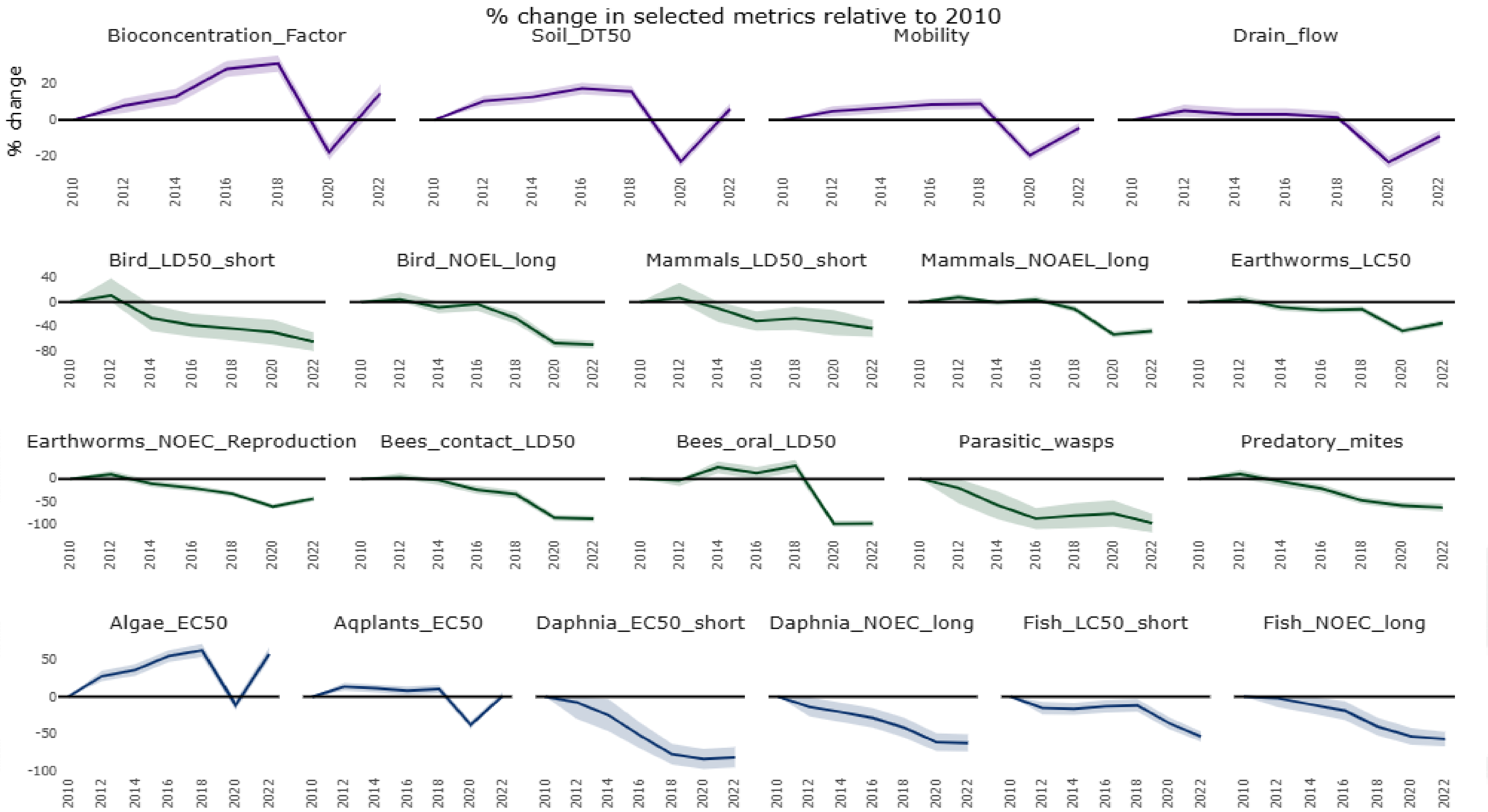
10%

Relative Change in Load Metrics between 2010 & 2018
[All Arable crops; allregions; All Pesticides]



2010 – 2018 Changes (relative % increase or decrease)




% change in selected metrics relative to 2010
% change
Bioconcentration_Factor
Soil_DT50
Mobility
Drain_flow
Bird_LD50_short
Bird_NOEL_long
Mammals_LD50_short
Mammals_NOAEL_long
Earthworms_LC50
Earthworms_NOEC_Reproduction
Bees_contact_LD50
Bees_oral_LD50
Parasitic_wasps
Predatory_mites
Algae_EC50
Aqplants_EC50
Daphnia_EC50_short
Daphnia_NOEC_long
Fish_LC50_short
Fish_NOEC_long
2010
2012
2014
2016
2018
2020
2022

PLI visualisation tool – parasitic wasps

Load on parasitic wasps, UK arable crops 2010-2022