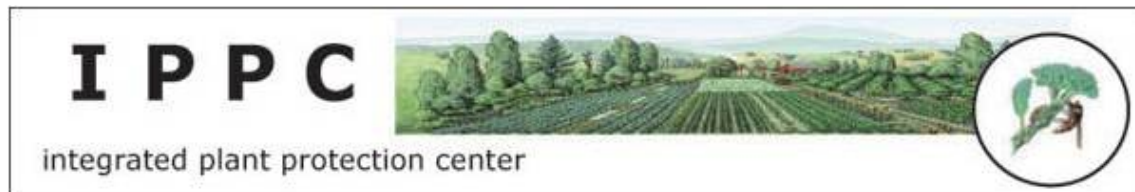


# Predicting and managing pesticide risks to bees

**Paul Jepson**  
Oregon State University



**OSU**

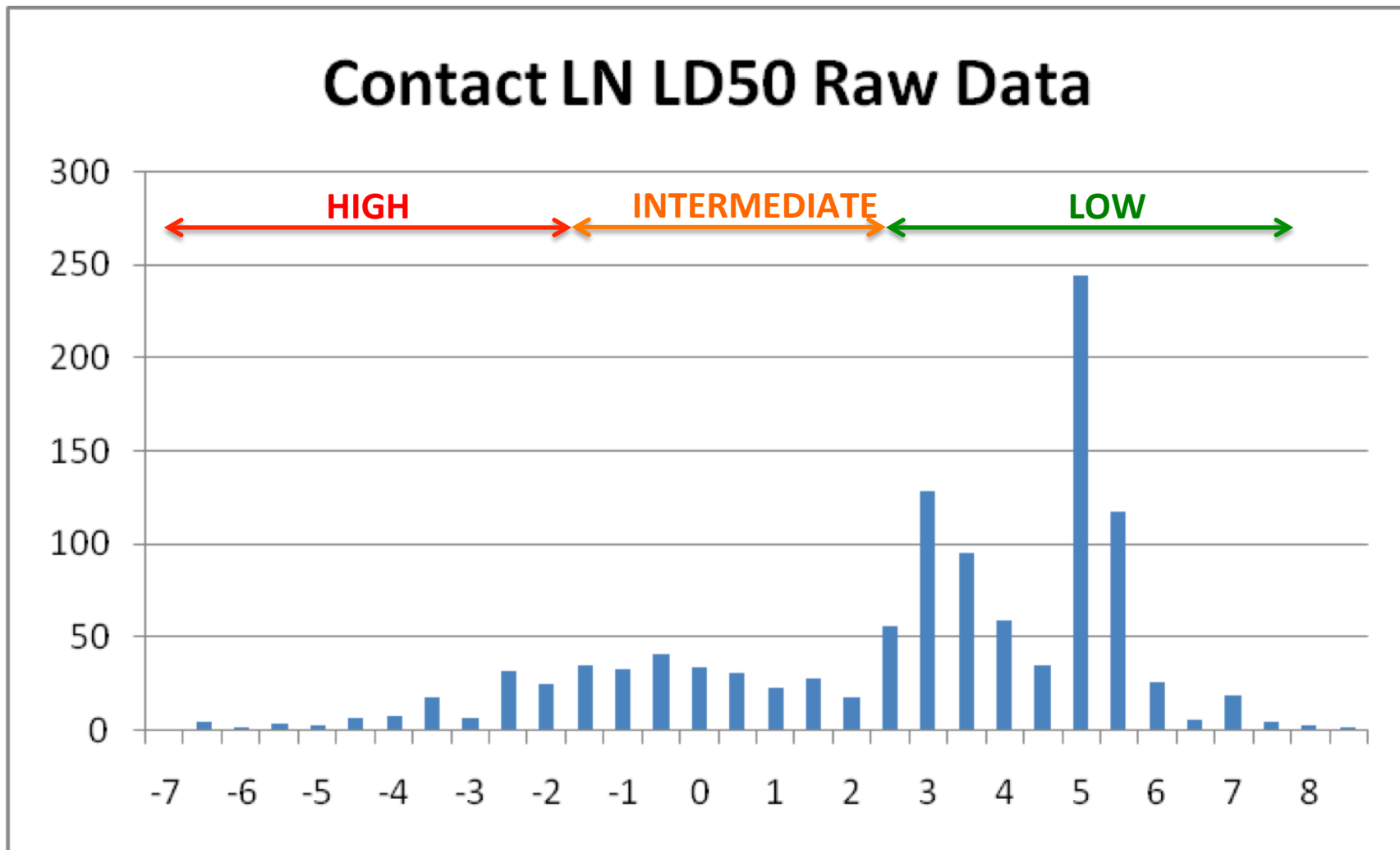
# Background

- State IPM coordinator
- Research in invertebrate ecotoxicology
- Discovered toxic synergism between fungicides and pyrethroids affecting pollinators (1,2)
- Leading program in pesticide risk assessment and management, and alternatives to pesticides
- Global engagement with farmers, agencies, industry and regulators

1. Pilling, E.D., Bromley-Challenor, K.A.C., Walker, C.H., Jepson, P.C. (1995) Mechanisms of EBI fungicide synergism with a pyrethroid insecticide in the honeybee. *Pesticide Biochemistry and Physiology* **51**, 1-11.

2. Pilling, E.D., Jepson, P.C. (1993) Synergism between EBI fungicides and a pyrethroid insecticide in the honeybee (*Apis mellifera* L). *Pesticide Science*, **39**, 293-299.

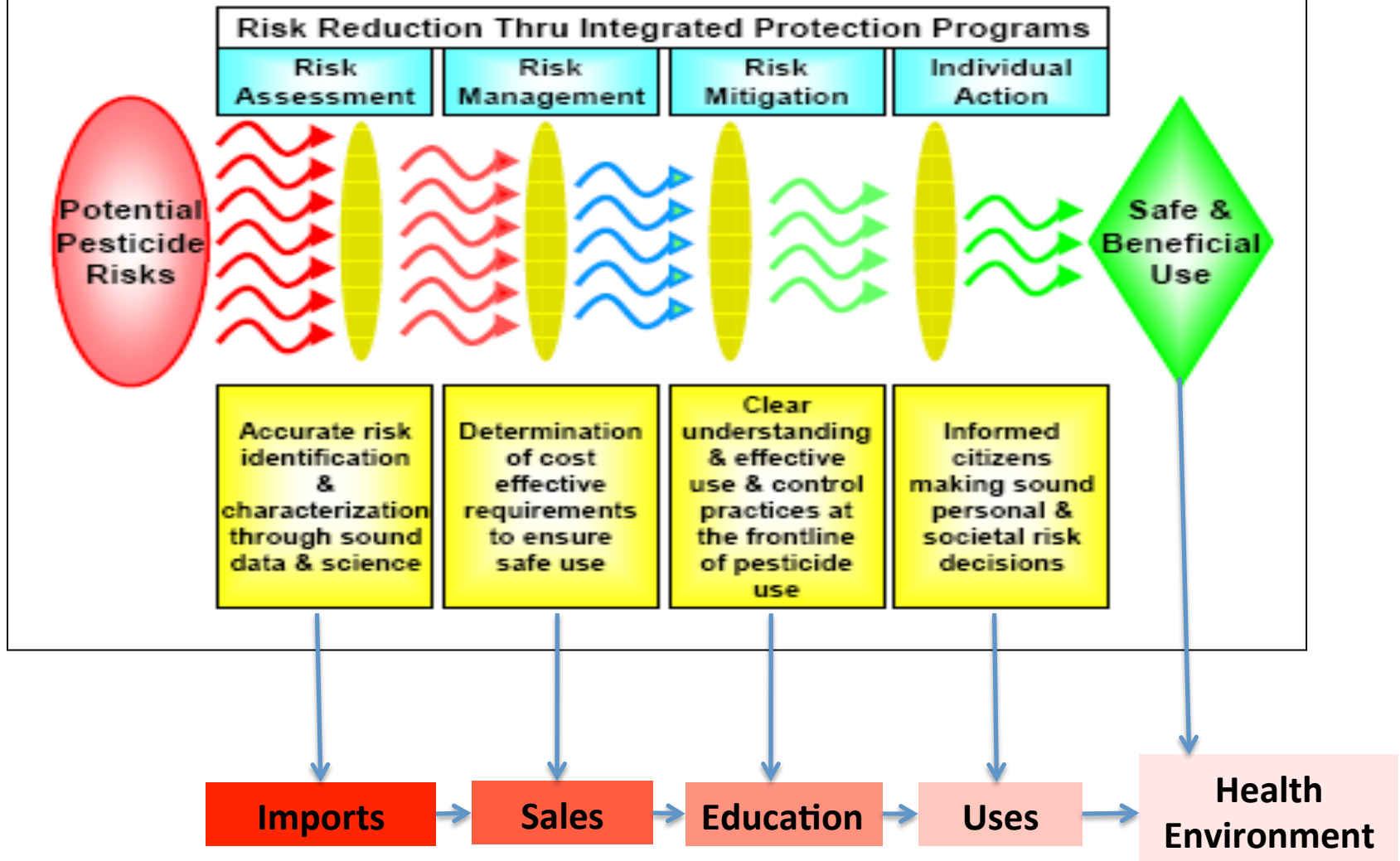
**Many pesticides are toxic to *Apis mellifera***  
*(Jepson, unpublished data)*



Hazard classification from Atkins et al (1981) Reducing pesticide hazard to honeybees

## FIFRA/FFDCA Statutory Scheme

Multiple interconnected programs in recognition that no single, independent action or stakeholder can ensure adequate protection.



US Pesticide regulation is set up to incorporate effective education as a key final step in pesticide risk management – in Oregon, this education is provided by OSU extension and others

# Farmers have a history in Oregon of responding to pesticide risks, and reducing them

E.g. pesticide stewardship partnerships

**Paul Jepson, Mary Halbleib,**

Oregon State University

**Kevin Masterson,**

Oregon Department of Environmental Quality

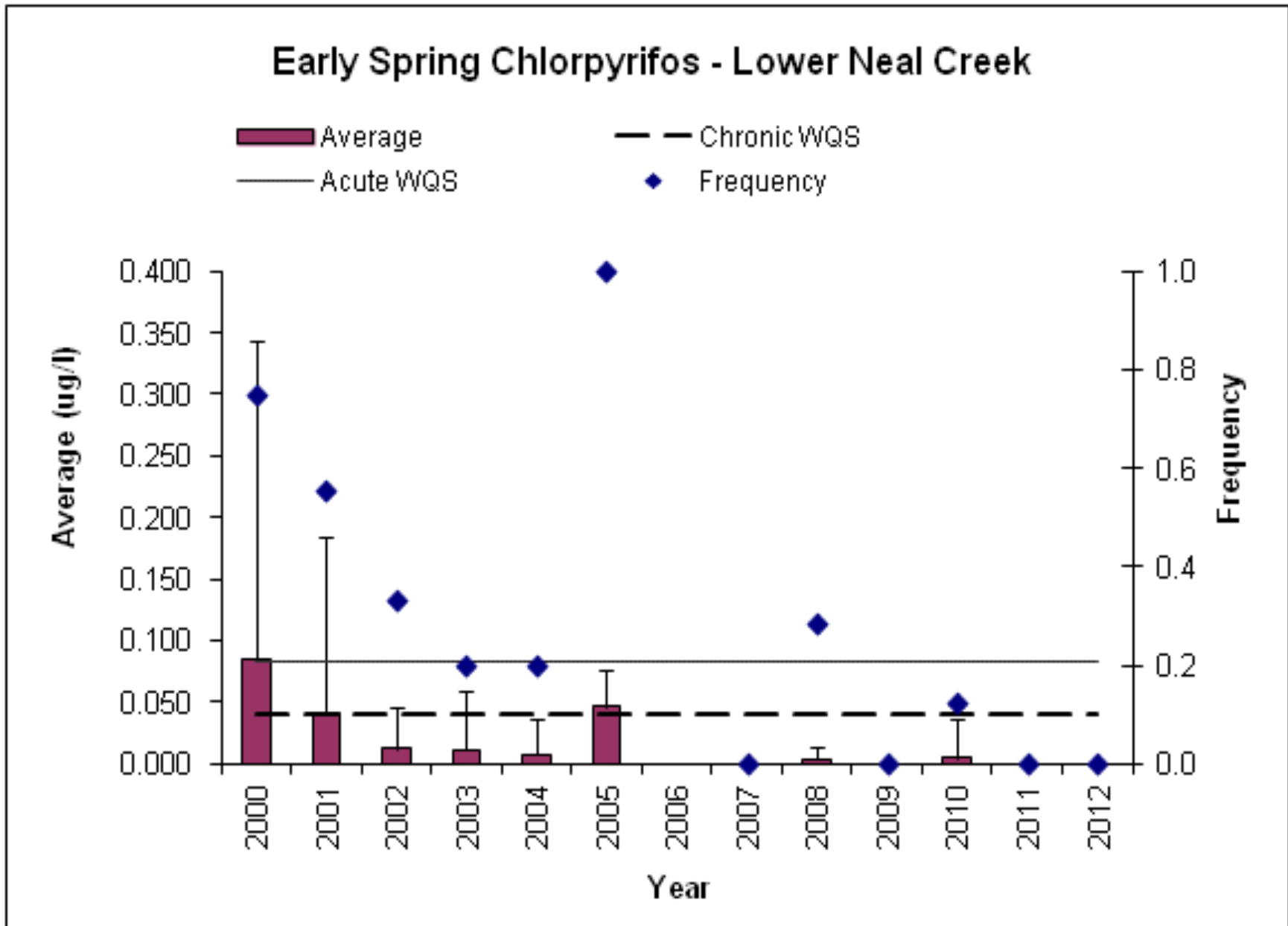
+ about 4,000 farmers



**OSU**

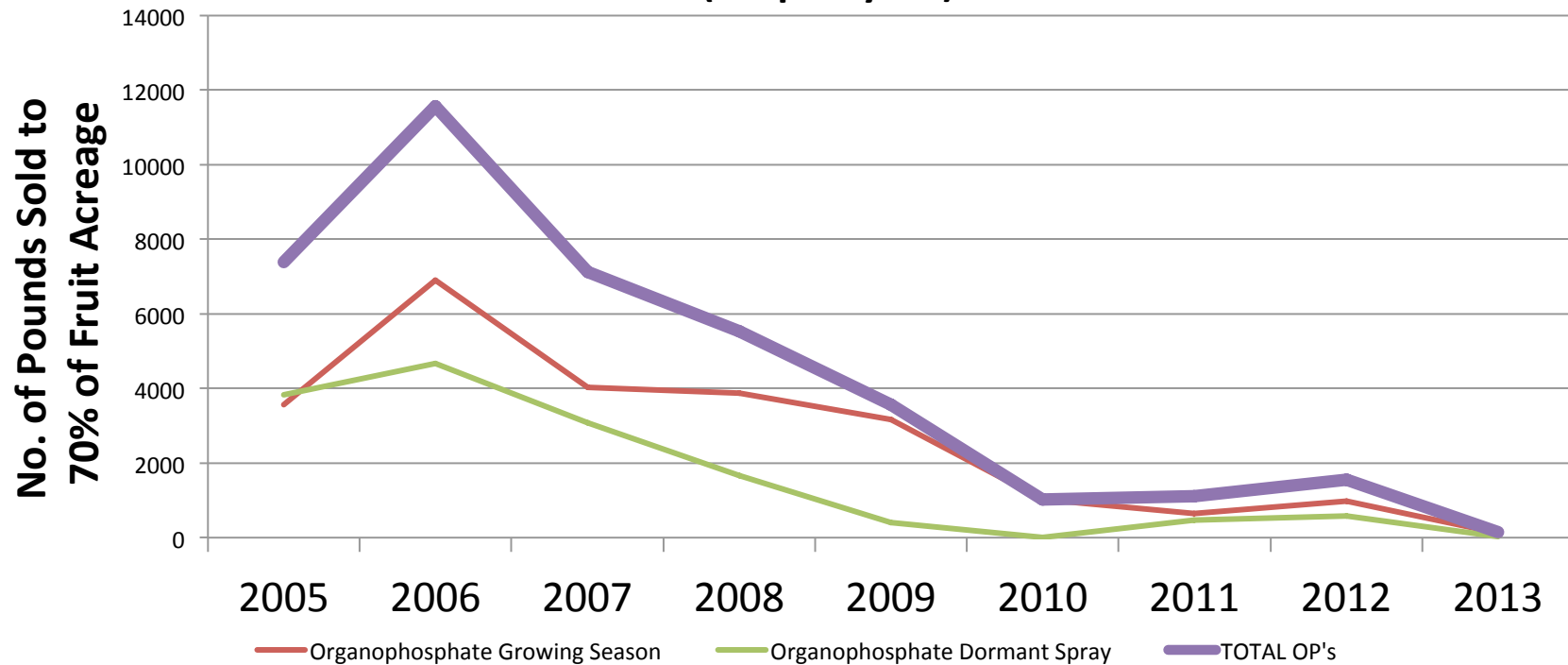
[jepsonp@science.oregonstate.edu](mailto:jepsonp@science.oregonstate.edu)

# Pesticide Stewardship Partnership Results Hood River, Oregon



**In the Walla Walla Valley, another successful PSP has developed new monitoring and decision support tools for farmers, and focused on using pesticides that are less toxic to fish. OP use has fallen considerably since 2006**

**Organophosphates Sold to Orchardists in Walla Walla Valley  
(lbs per year)**



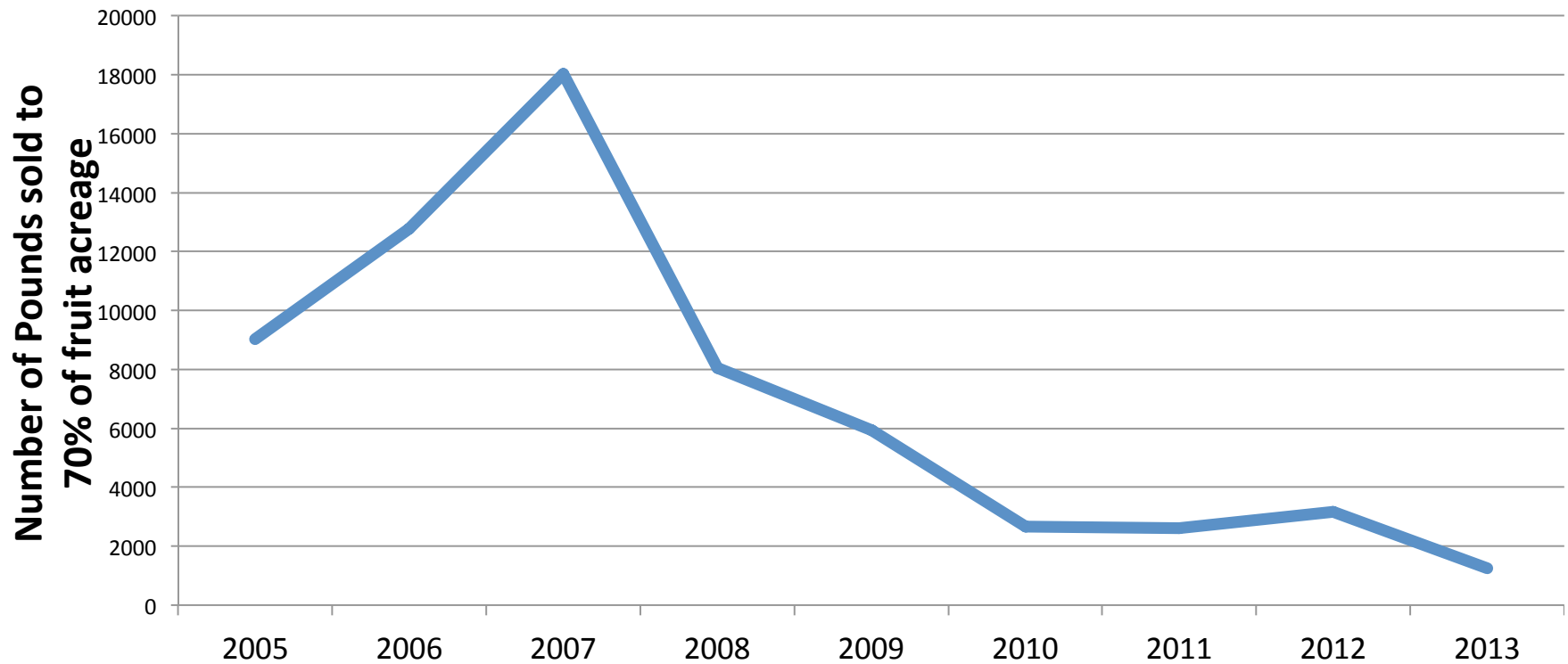




**NOTE ALSO: Transitioning out of broad spectrum pesticides, supported by education and decision support tools from IPM extension education, ultimately leads to greatly reduced pesticide use of any type**

**BUT, IPM Requires lower risk pesticide alternatives in the key transitional phases when the system is recovering**

**Cumulative Insecticide Sold in Walla Walla Valley (lbs per year)**



A web-based [pesticide risk tool](#) for pollinators and natural enemies is now used in IPM extension in Oregon

[This is the state-of-the-science tool](#)

Farmers have responded very positively, and there is extremely high attendance at extension events that address pollinator impacts

**Inputs**

**ChemName** is an autocomplete textbox. Start typing letters in the textbox, wait a second or so, then pick from suggested names.

ChemName Search Mode  contains  starts with

**SprayDRClass** designates the amount of drift after drift reduction technology; 20 pct is the most effective, and 100 pct signifies no reduction.

Id	219
ChemName	Dimethoate<<60-51-5>>
log10Kow	-1.52
Rate	340
RateUnits	g/ha
GanzelmeierCropTypeSimple	LowBoom
SprayDRClass	SDRF_100_pct

**Results**

Each HQ is a hazard quotient: rate [g/ha] / LD50 [ug/bee]. If the log10(Kow) < 4.0, then a systemic adjustment factor is applied, increasing the HQ by a factor of 10. The HQ qualified by distances reflect the drift deposited at that distance from the spray; drift is affected by the choice of equipment above.

Id	219
HQApisField	34596
HQApis_1m	958
HQApis_3m	578
HQApis_5m	197
HQApis_10m	100
HQApis_20m	52
NEToxEst	0.537
Systemic factor 10 applied. LogP = -1.5. NE Pr/tox	

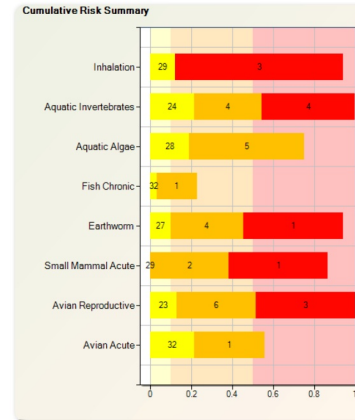
E.g. IPPC workshop in Wilsonville, OR for blueberry farmers:

*Bee risks are actively considered in IPM extension*

Grower program, 2012, Willamette Valley

Blueberries

<span style="color: yellow;">■</span>	N Low Risk	
<span style="color: orange;">■</span>	N Medium Risk	
<span style="color: red;">■</span>	N High Risk	
<b>Summaries</b>		<b>Overall</b>
N Missing		5
N Passes		27
N High Risk		12
N Medium Risk		23
N Low Risk		197
Grand Total		264



HIGH CUMULATIVE RISK FOR OVERALL CURRENT PROGRAMS

Blueberry SWD bee risks

Pesticide	Field	1m	3m	5m	10m	20m
Assail (F)	Red	Orange	Orange	Green	Green	Green
Brigade (E)	Red	Orange	Orange	Green	Green	Green
Sevin (G)	Red	Orange	Orange	Green	Green	Green
Diazinon (E)	Red	Orange	Orange	Green	Green	Green
Asana (E)	Red	Orange	Orange	Green	Green	Green
Danitol (E)	Red	Orange	Orange	Green	Green	Green
Provado 1.6F (F)	Red	Orange	Orange	Green	Green	Green
Malathion (E)	Red	Orange	Orange	Green	Green	Green
Lannate (E)	Red	Orange	Orange	Green	Green	Green
Imidan (G-E)	Red	Orange	Orange	Green	Green	Green
Pyganic (G)	Green	Green	Green	Green	Green	Green
Delegate (E)	Green	Green	Green	Green	Green	Green
Entrust, Success (G-E)	Red	Orange	Orange	Green	Green	Green
Actara (F)	Red	Orange	Orange	Green	Green	Green
Mustang Max (E)	Red	Orange	Orange	Green	Green	Green

Blueberry SWD pesticide toxicity to natural enemies

Pesticide	Para adult	Para larva	Pred bugs	Pred mites
Assail (F)	60-75%	<25%	>75%	Red
Brigade (E)	Red	Orange	Red	Red
Sevin (G)	Red	Orange	Red	Red
Diazinon (E)	Red	Orange	Red	Red
Asana (E)	Red	Orange	Red	Red
Danitol (E)	Red	Orange	Red	Red
Provado 1.6F (F)	Red	Orange	Red	Red
Malathion (E)	Red	Orange	Red	Red
Lannate (E)	Red	Orange	Red	Red
Imidan (G-E)	Red	Orange	?	Red
Pyganic (G)	Red	Green	Red	Red
Delegate (E)	?	?	?	?
Entrust, Success (G-E)	Red	Orange	Red	Red
Actara (F)	Red	Orange	Red	Red
Mustang Max (E)	Red	Orange	Red	Red

SWD pesticide mode-of-action for rotation (+PHI)

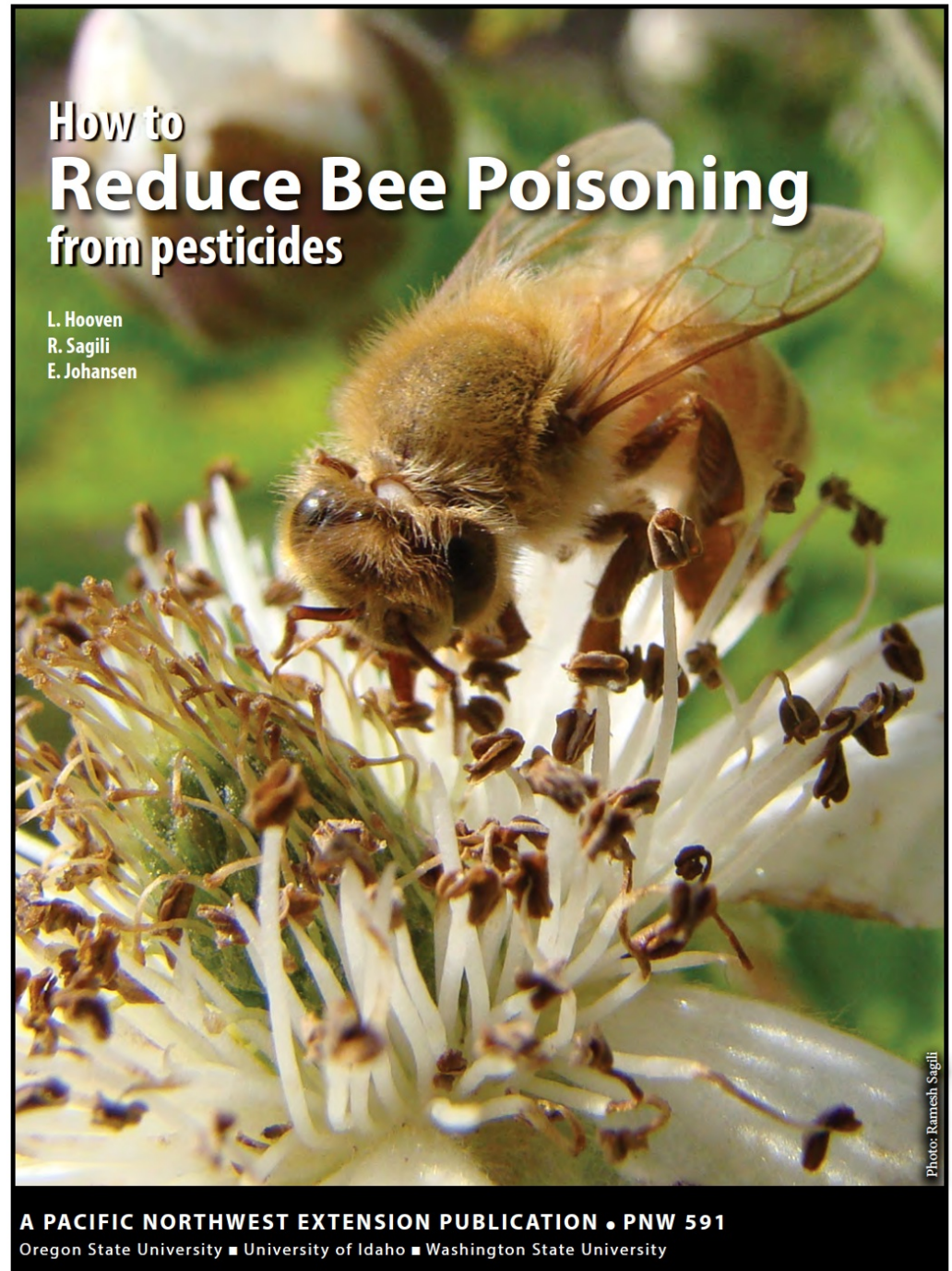
Chemical class	Pesticide
Nitroguanidine nicotinoid	Provado 1.6F (3), Actara (3)
Pyridylmethylamine nicotinoid	Assail (1)
Spinosyn	Delegate (3), Entrust (3), Success (3)
Botanical	Pyganic (0)
Pyrethroid	Brigade (1), Asana (14), Mustang max (1)
Pyrethroid ester	Danitol (3)
Carbamate	Sevin (7)
Oxime carbamate	Lannate (3)
Pyrimidine organothiophosphate	Diazinon (7)
Aliphatic organothiophosphate	Malathion (1)
Isoindole organothiophosphate	Imidan (3)

**THE CHALLENGE FOR FARMERS IS TO SELECT A SUITE OF PESTICIDES THAT MAXIMIZE EFFICACY, MINIMIZE BEE AND NATURAL ENEMY RISKS, CONTAIN DRIFT AND RUN-OFF, RETAIN RESISTANCE ROTATION, AND MEET PRACTICAL REQUIREMENTS FOR WORKER-REENTRY AND PRE-HARVEST INTERVAL, AND THE MARKETPLACE**

## ***There are many ways to minimize pesticide impacts on bees***

**Pesticides cause significant damage to beneficial insect populations.**

- Prevent overspray or drift onto adjacent habitat
- Use most targeted application
- Use active ingredients with least impact on beneficials
- Don't spray on plants in bloom
- Spray at night and when dry
- Consider alternatives:
  - Pheromone traps and baits
  - Pest-resistant crops, biological control



# Conclusions

1. Expect more changes in pesticide regulation to protect bees
2. BUT, effective regulations that balance production and protection goals take time
3. Education is an effective complement to regulation, and part of the US process
4. Farmers respond to risk challenges in Oregon, but there are many risks that may conflict with each other – bees, fish, birds, people – risk substitution is a likely consequence of sudden changes in the marketplace
5. Alternatives to pesticides within IPM programs are important also, we have a globally leading program in Oregon, and we have refocused to address pollinator risks