Pollinator Declines and the Role of Pesticides in Honey Bee Health

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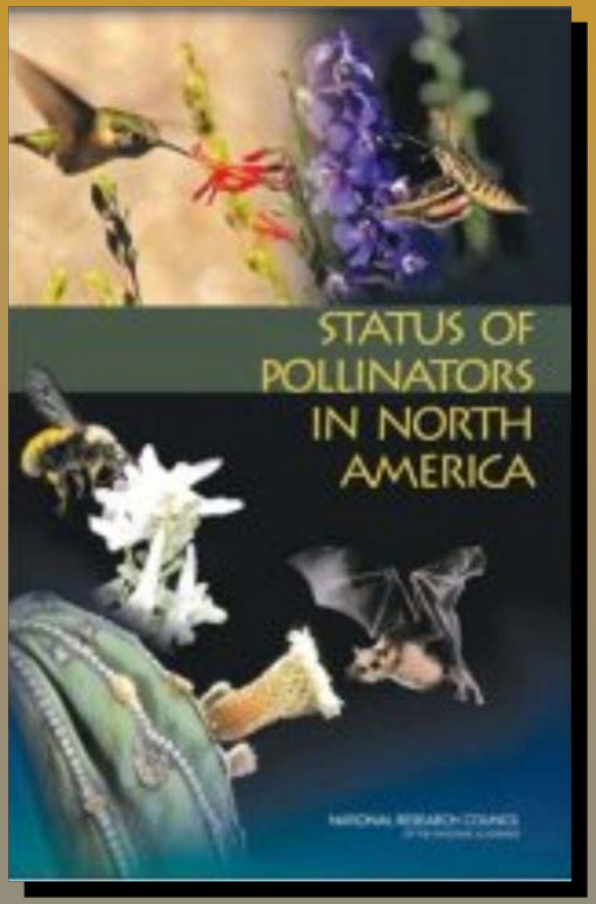
Worldwide Pollinator Declines



- National Academies of Science
- *Status of Pollinators in North America*
- 2007
- Pollinators are in decline

http://www.nap.edu/catalog/11761.html

Pesticides

Large scale Agriculture

Habitat destruction

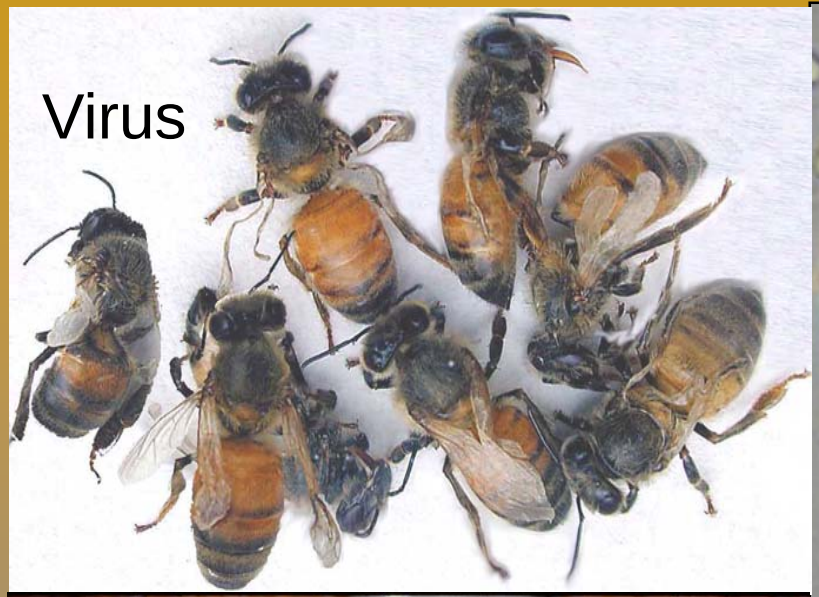
Urbanization

Monocultures

Fewer field margins

Nutritional value ?

Honey Bee Diseases and Pests



Colony Collapse Disorder (CCD)

- *Rapid loss of adult worker bees*
- *Few or no dead bees in colony*
- *Colonies dead with excess brood*
- *Small cluster with queen present*

(vanEngelsdorp, Pettis et al. PLoS One 2009)



CCD Working Hypothesis

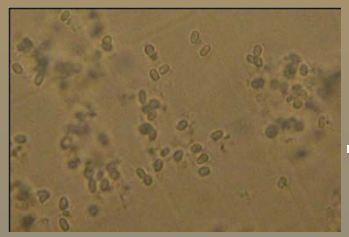
Primary Stress

Varroa Mites

Management
Nutrition
Pesticides

Secondary Pathogens

Viruses



Nosema

Fungi


Pollinators


Pesticides


Plants

Surveys for pesticide exposure

Chauzat et al. 2006 France

systemics found in 69% of pollen samples

1.1 to 5.7 ppb levels

Mullen et al. 2010 United States

systemics found in 61% of pollen samples

1 to 1436 ppb levels

Possible pesticide-pathogen interaction

- Expose bees to pesticides at low levels
  (sub-lethal)
  (Univ. of Maryland)
- Challenge with Nosema
- Determine Nosema infection rates

Possible pesticide-pathogen interaction

Imidacloprid fed in MegaBee protein patty over 10 weeks to full size honey bee colonies

Control	5 ppb	20 ppb
N = 10	N = 10	N = 10

Emerging brood combs pulled from 4 colonies of each treatment group at week 6 of exposure

Emerged bees fed sucrose with ca. 250,000 spores per bee over a two day period in laboratory cages

Bees removed on day 12 and Nosema counts performed on individual bees (n=10 / cage).

Pesticide – pathogen interactions:

Honey bee colonies do get exposed to a wide variety of pesticides (Mullin et al. *PLoSONE* 2010)

Two recent lab studies have demonstrated that sub-lethal exposure to some pesticides can increase pathogen levels in bees, Nosema levels increased after exposure to imidacloprid

Alaux et al. *Environ. Micro*. 2010
Pettis et al. (in review)

Spores of the gut parasite Nosema

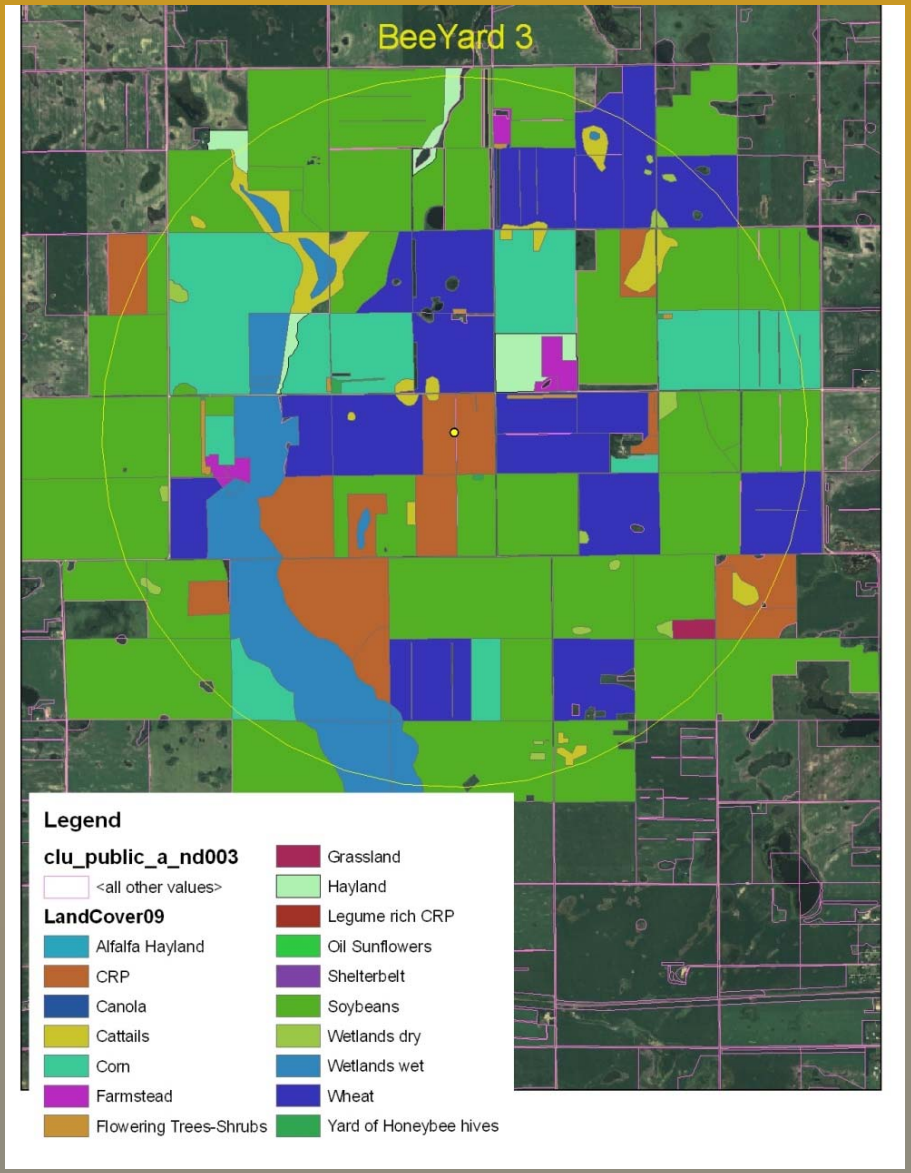
Real-world pesticide exposure and colony level effects

Effects of summer / fall nutrition on colony survival in the Midwest

Monitor pollen

- Quantity
- Protein content
- Pesticide load
- ½ of colonies fed protein @ each site

USGS will map land use and crop type in each site



For Bee Yard #3

Soybeans = 43%

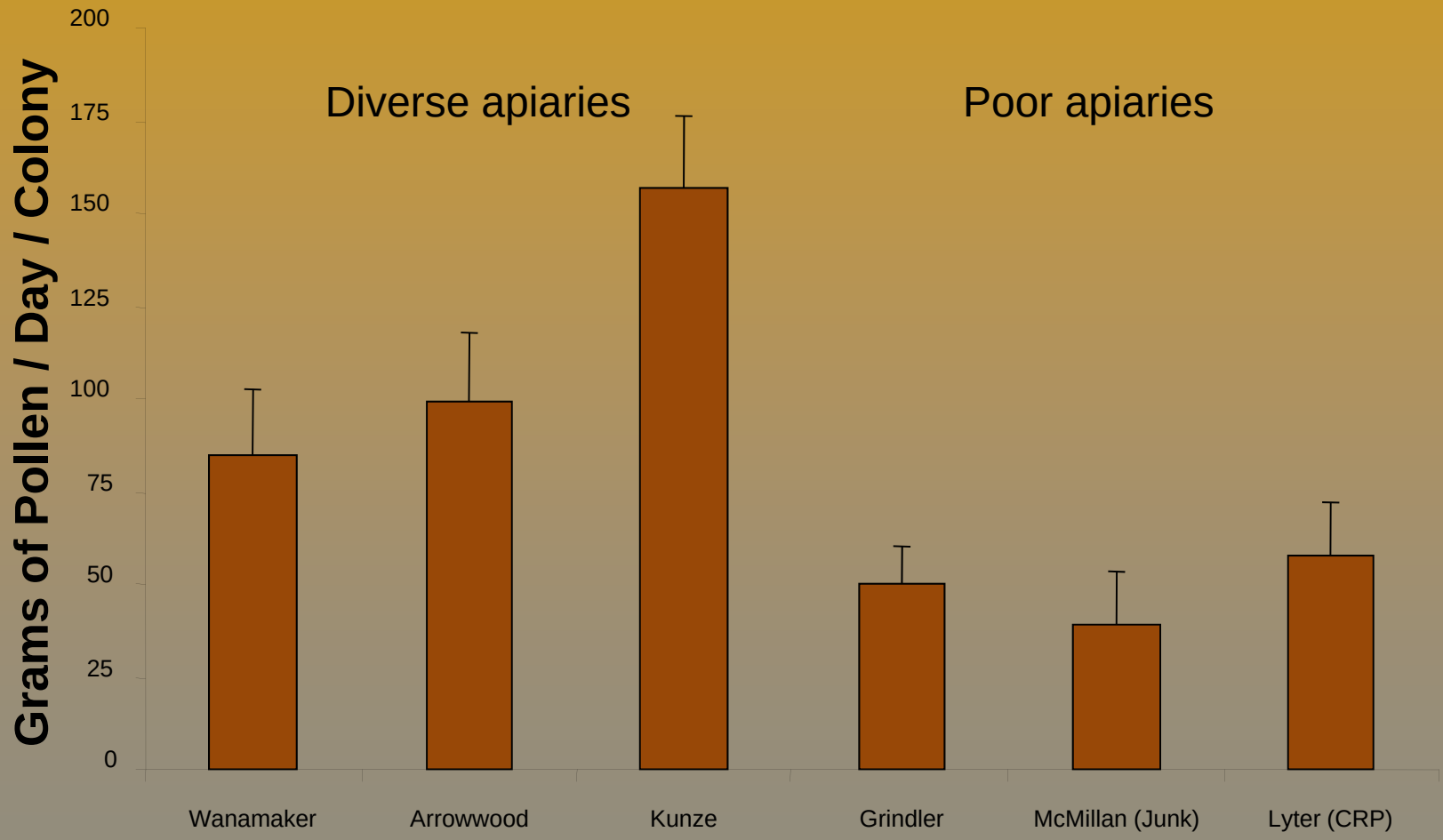
Corn = 10%

CRP = 7%

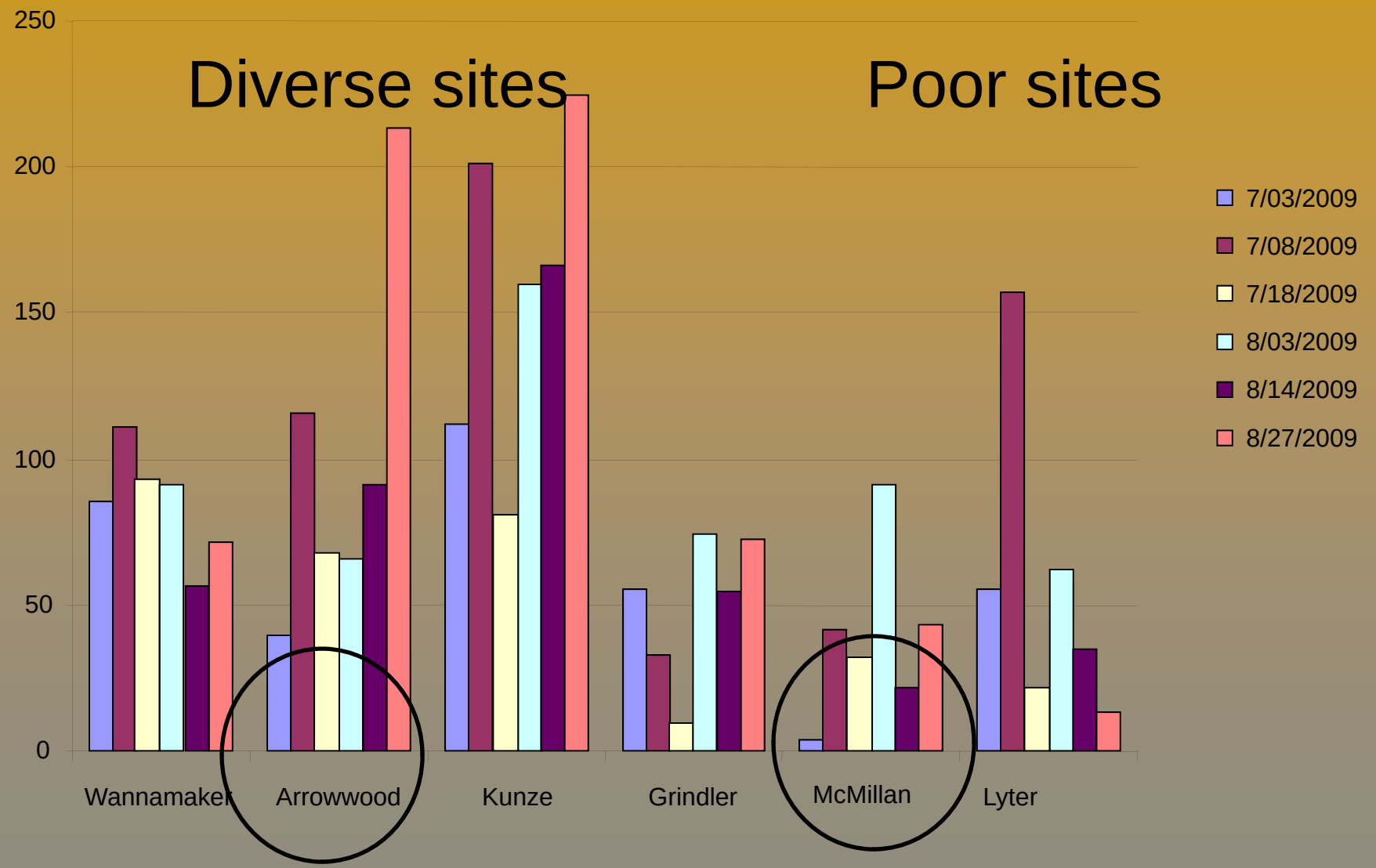
Canola = 22%

Pollen collected at each site will confirm bee forage

Pollen Collection in 6 ND Apiaries

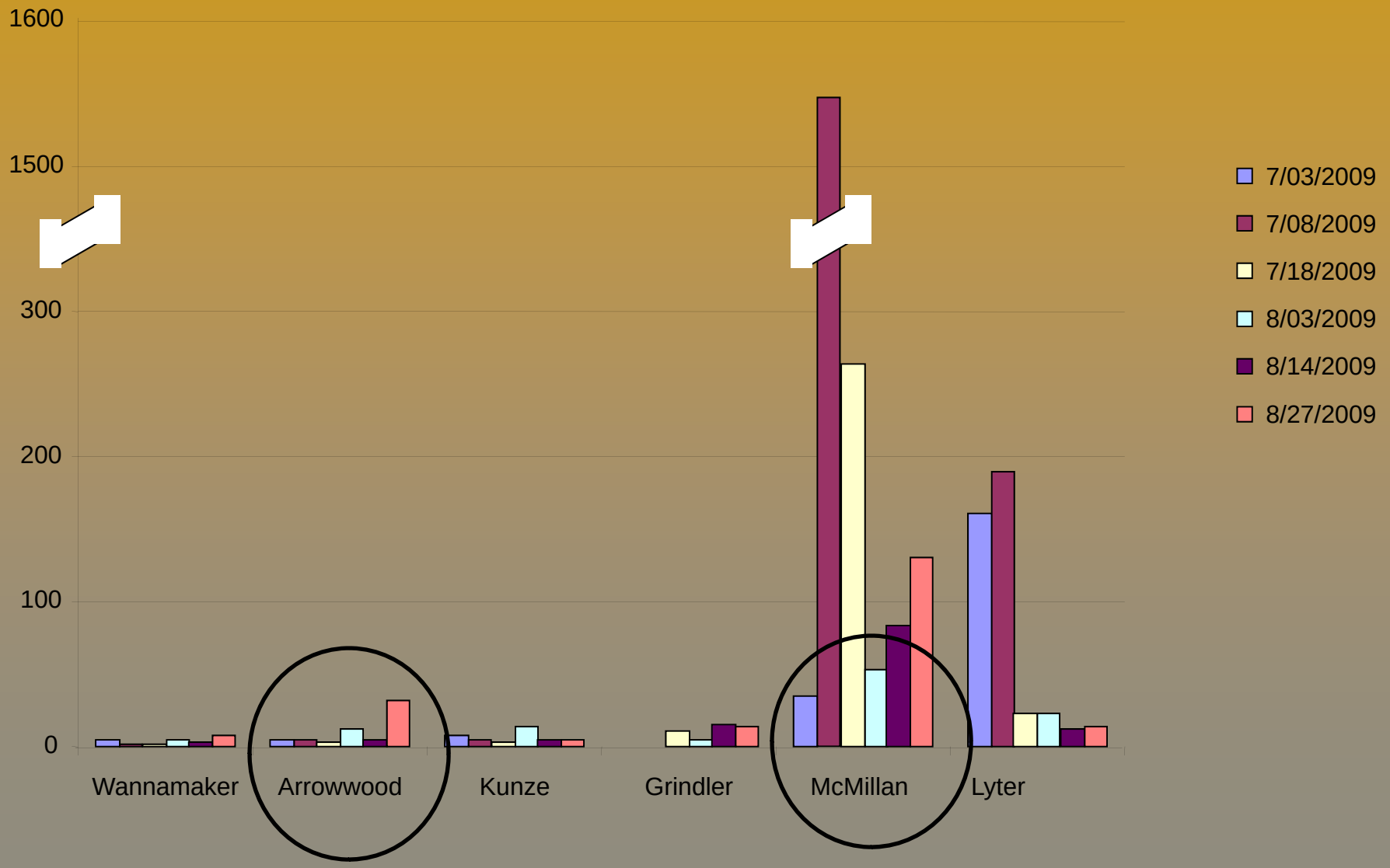


Grams of Pollen / day from 6 apiaries in North Dakota

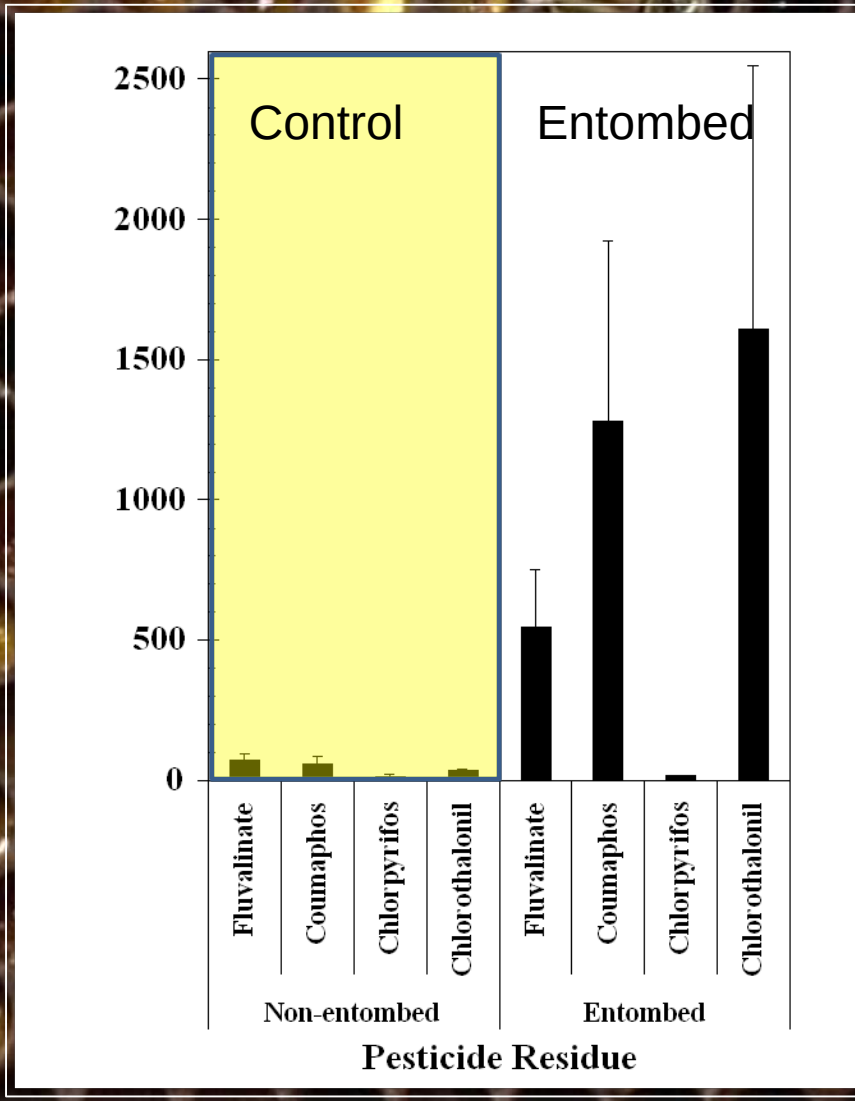


Chlorpyrifos in Collected Pollen (ppb) in North Dakota

(**Chlorothalonil , a fungicide, was highest in pollen in 2010)



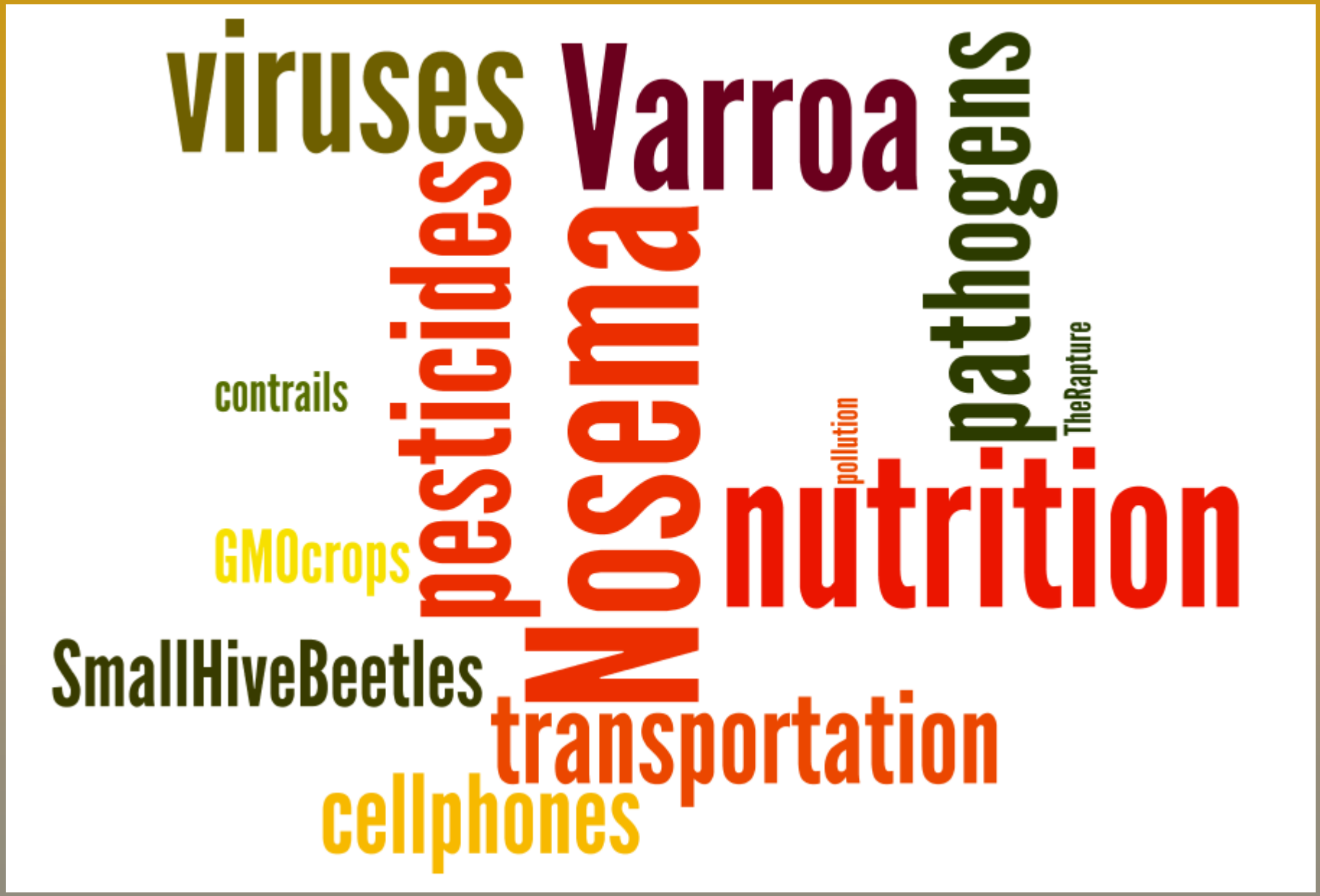
Entombed pollen = high fungicide content

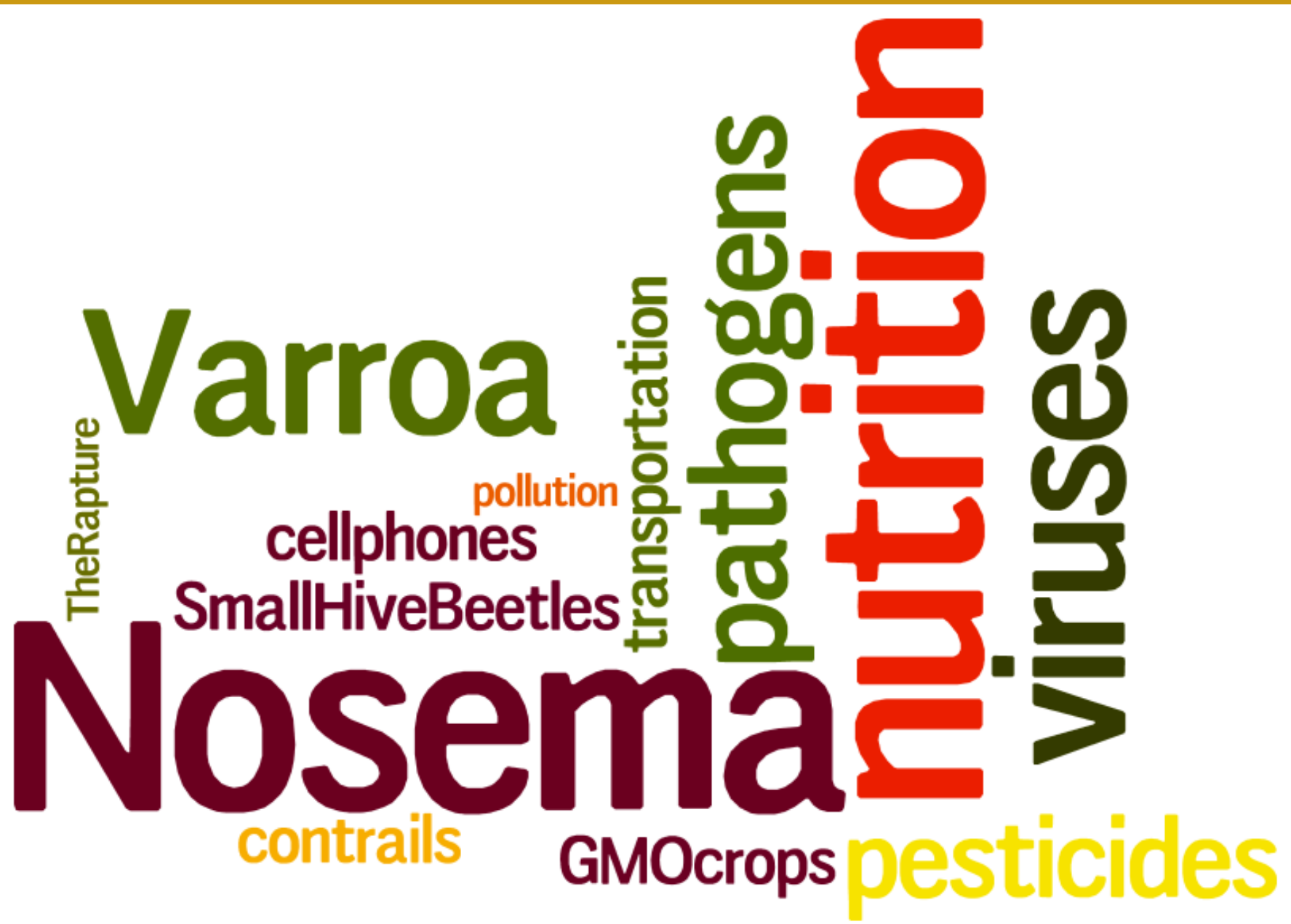


vanEngelsdorp, Pettis *et. al* (2009) JIP

Pollinator Health Summary

- All pollinators are threatened
- Declining honey bee health is complex
- Pesticide / Pathogen interactions in lab studies
- Many Insecticides (systemics and conventional) and Fungicides are of concern


viruses
Varroa
pathogens
pesticides
Nosema
contrails
pollution
TheRapture
nutrition
GMOcrops
SmallHiveBeetles
transportation
cellphones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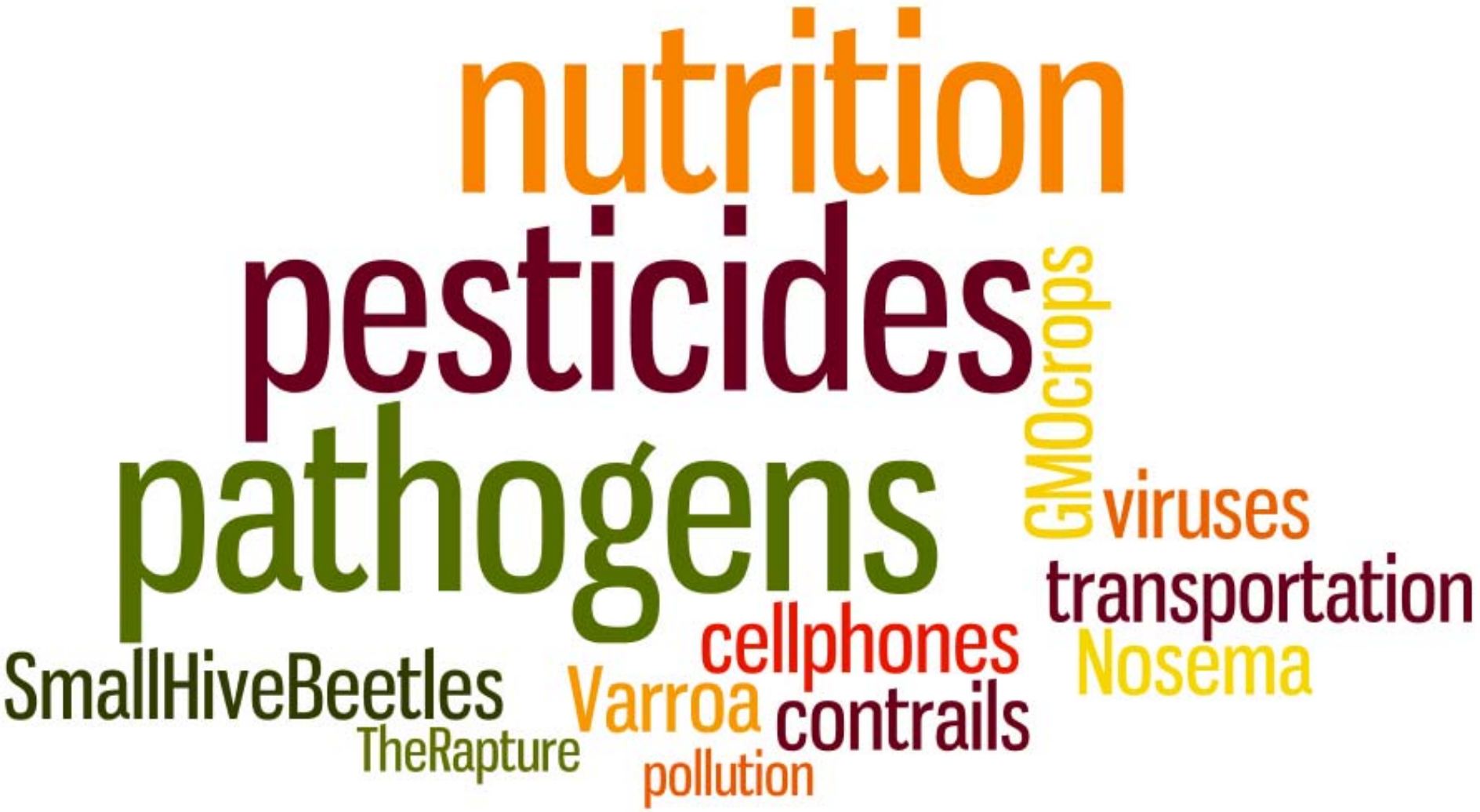
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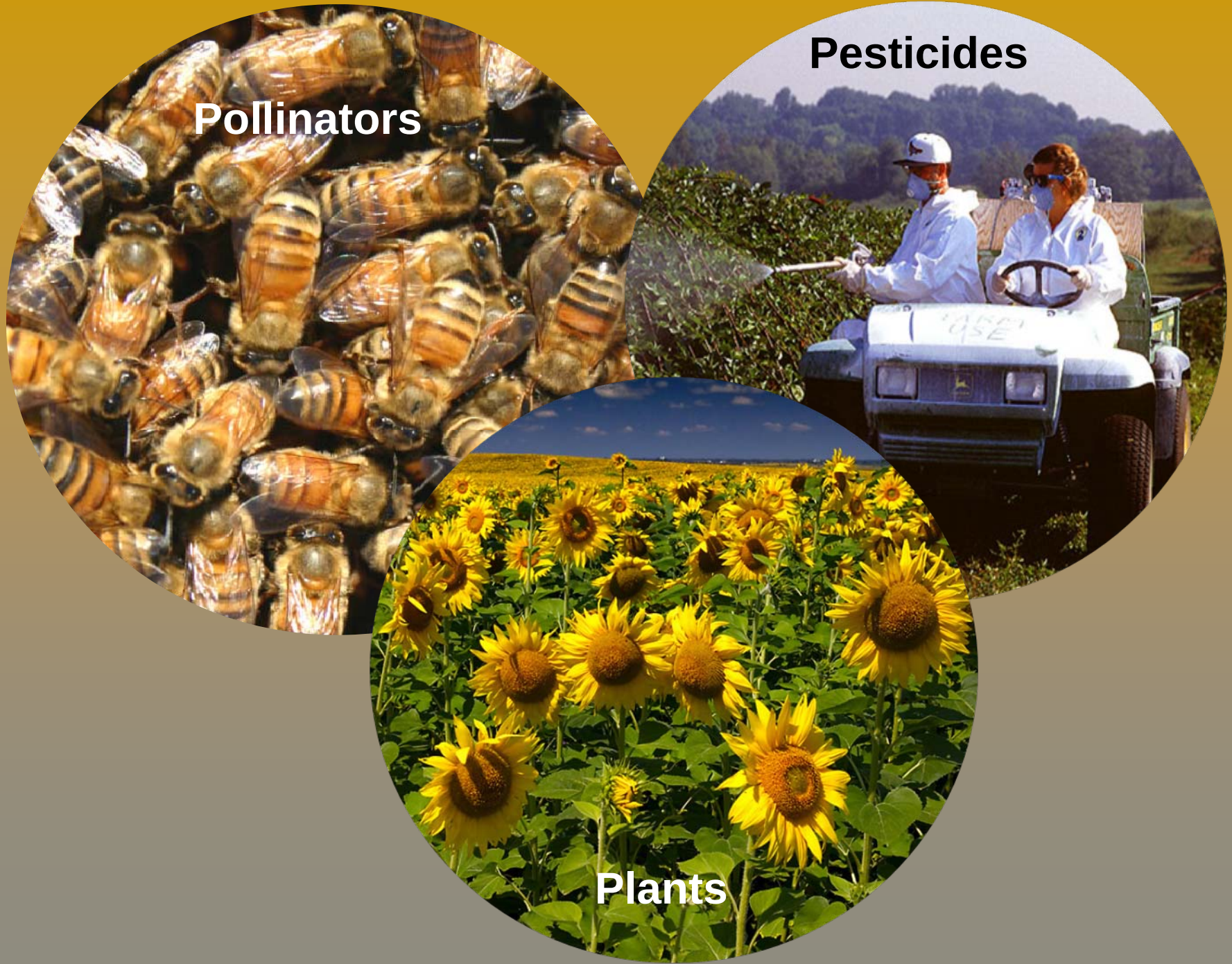
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