Benefits of Organically-Produced Foods: A Review of Research and Implications for Practice

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Speaking Honorarium – Organic Valley (2015)

Benefits of Organically-Produced Foods: Review of Research and Implications for Practice

Learning Objectives:

1) State the benefits of organically-produced foods.

2) Describe recent evidence showing the benefits of organically-produced foods as well as areas requiring further study.

3) Recognize the demonstrated benefits of organically-produced foods with clients, professionals, and the general public.

Presentation Overview

I. Organic vs. Conventional: Baranski *et al.* (2014) – Higher antioxidant content and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses. *British Journal of Nutrition.112:794-811*

II. Emerging Evidence: Consumption of Organically Produced Foods with Human Health Benefits

III. Environmental & Community Health Benefits of Organically-Produced Foods

IV. Resources for RDs/RDNs/DTRS and other Public Health Professionals

British Journal of Nutrition (2014), **112**, 794–811 doi:10.1017/S0007114514001366

Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses

Marcin Barański[1], Dominika Średnicka-Tober[1], Nikolaos Volakakis[1], Chris Seal[2], Roy Sanderson[3], Gavin B. Stewart[1], Charles Benbrook[4], Bruno Biavati[5], Emilia Markellou[6], Charilaos Giotis[7], Joanna Gromadzka-Ostrowska[8], Ewa Rembiałkowska[8], Krystyna Skwarło-Sońta[9], Raija Tahvonen[10], Dagmar Janovská[11], Urs Niggli[12], Philippe Nicot[13] and Carlo Leifert[1*]

Photo: Scott Butner under CC BY-NC-ND 2.0

Systematic Review & Meta-Analyses: Overview

The authors carried out meta-analyses based on 343 peer-reviewed publications that indicate statistically-significant and meaningful differences in composition between organic and non-organic crops/crop-based food.

Baranski et al. 2014. *British Journal of Nutrition.112:794-811.*

Materials and Methods

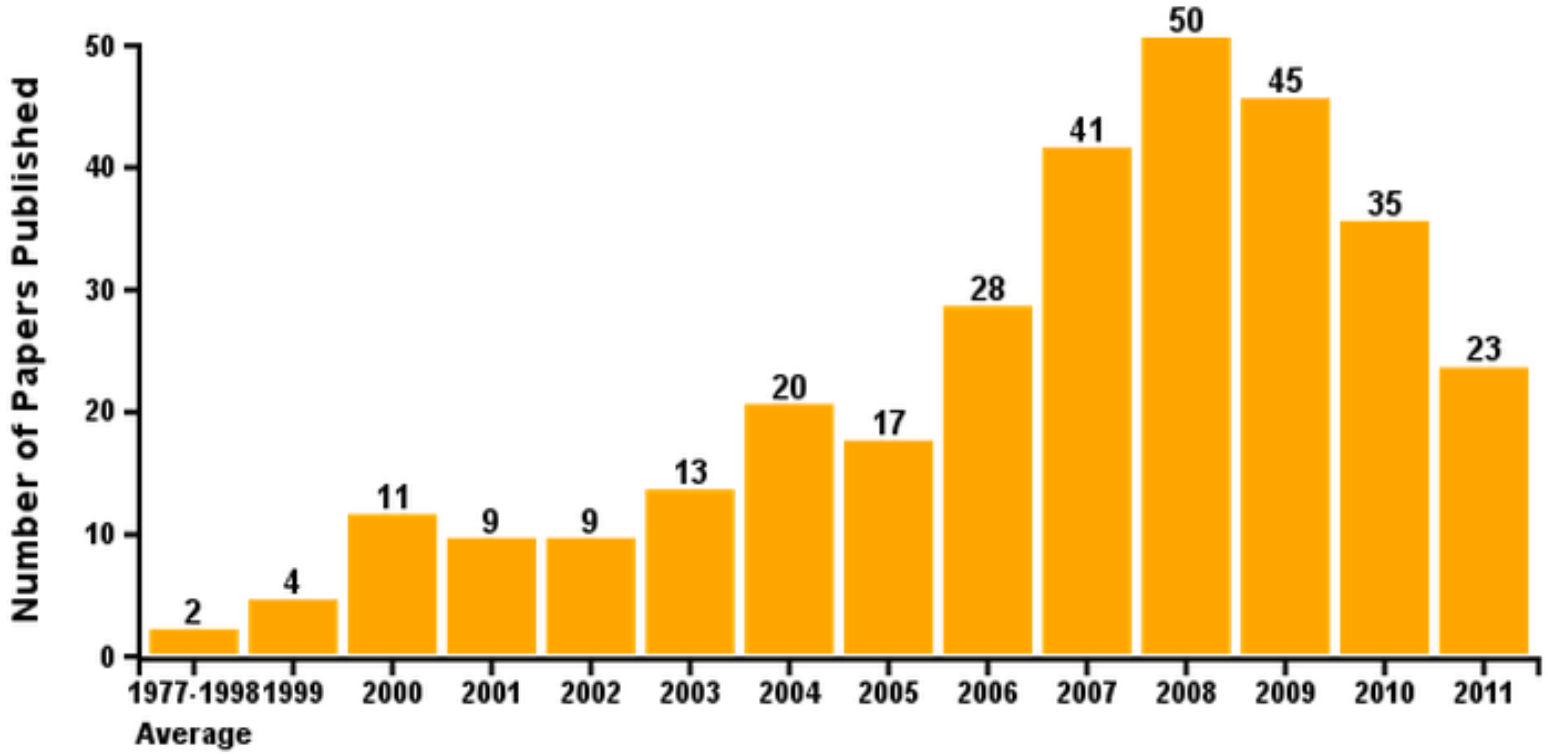
Literature search: Inclusion criteria and search strategy

The literature search strategy and meta-analysis protocols used were based on those previously published by Brandt et al. (Brandt et al., 2013).

Flow diagrams of the protocols used are provided (Baranski et al. 2014).

Baranski et al. 2014. *British Journal of Nutrition.112:794-811.*

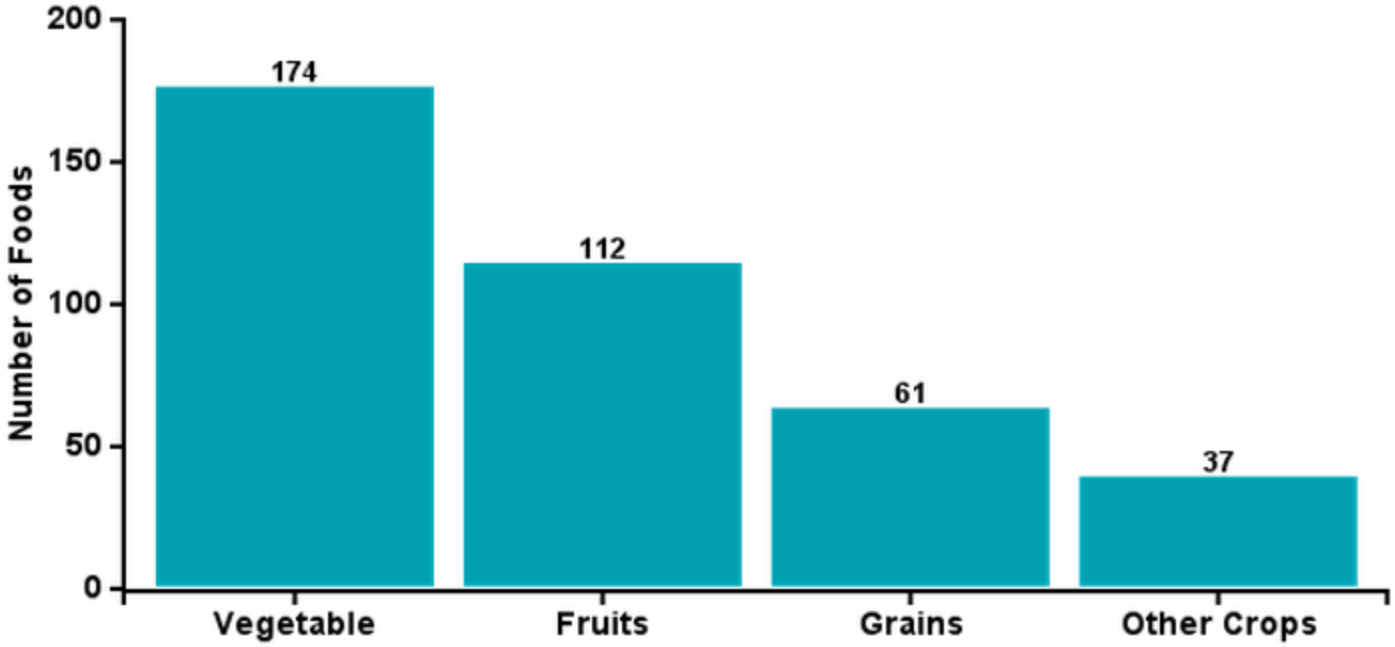
Figure 1: Number of Papers Published by Year



Notes: 17% of studies were published before 2002. 45% were published from 2008-2011, and since the Dangour et al. review, 17% of studies from 2010-2011.

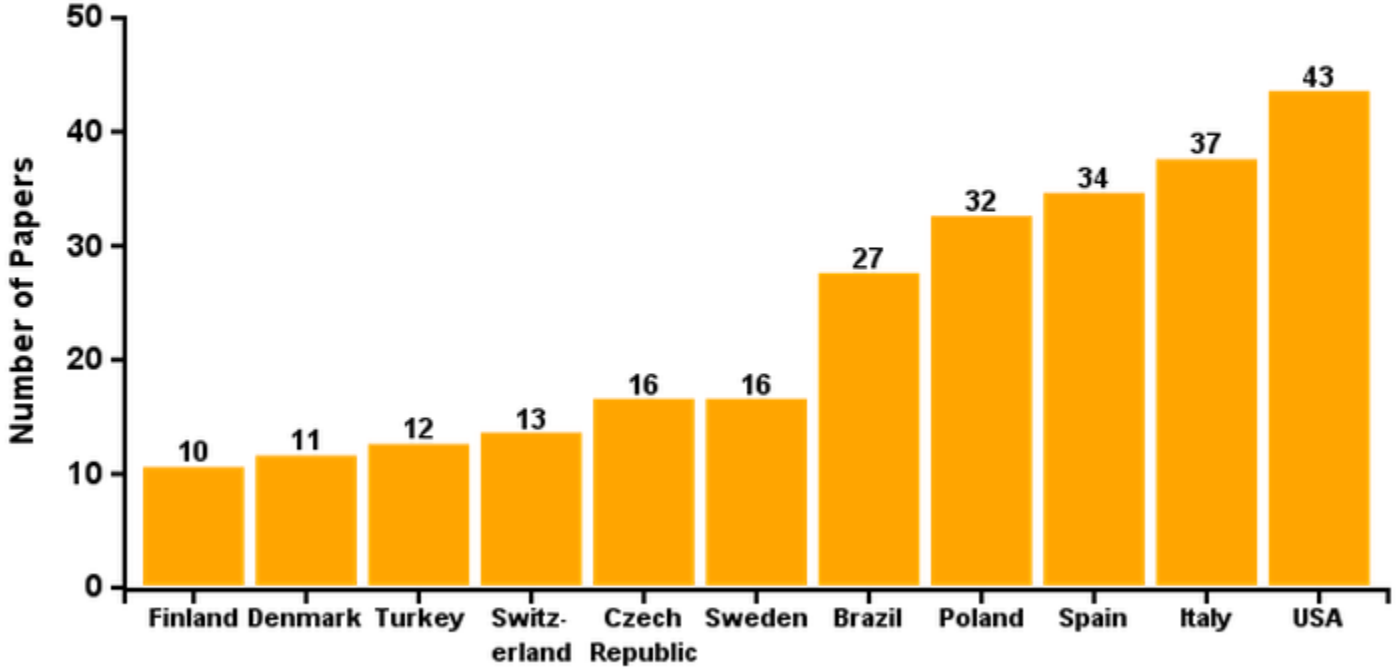
Source: Supplemental Figure 1 in the published paper.

Figure 2: Foods Analyzed in the 343 Studies Included in the BJN Study



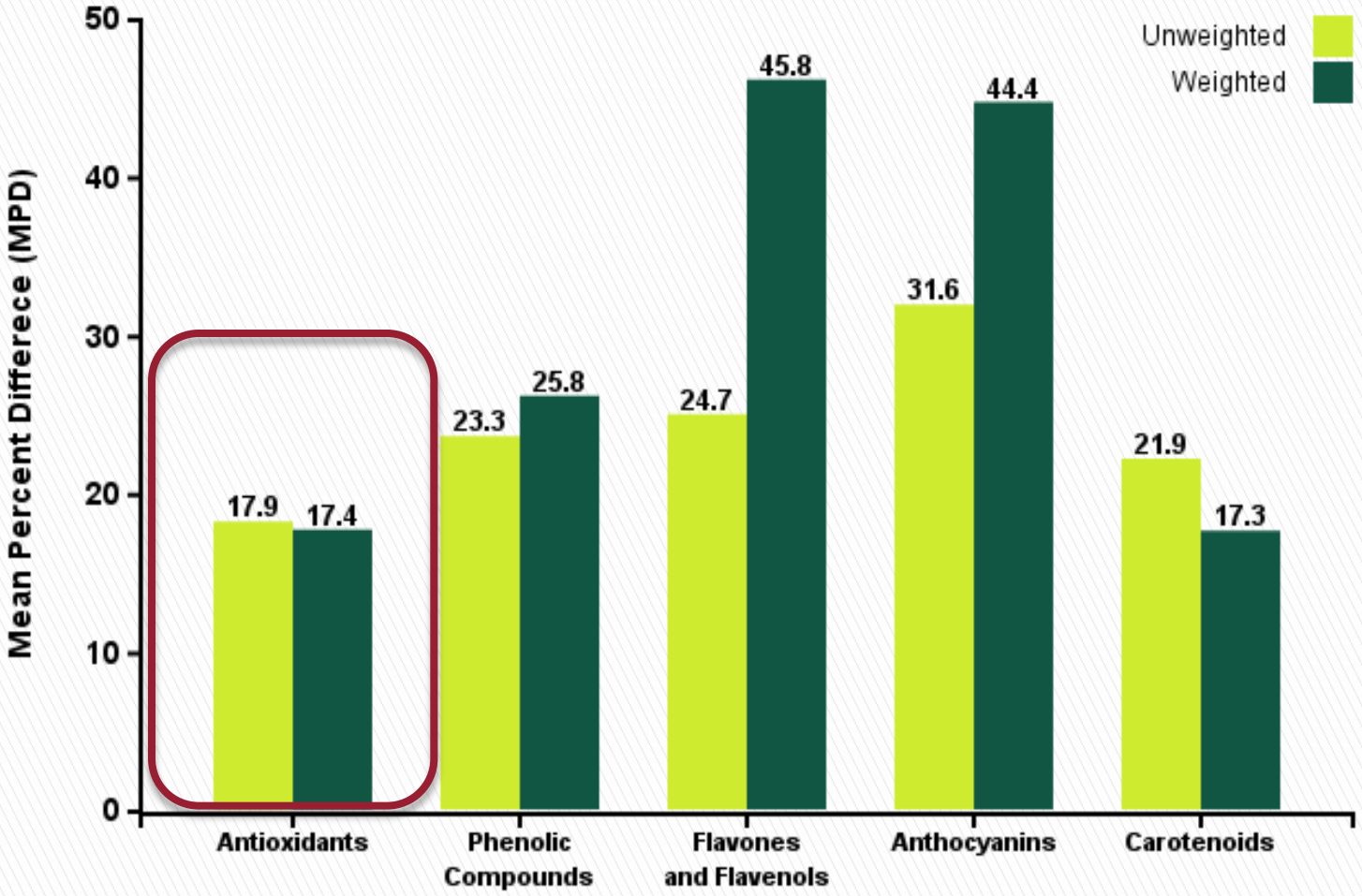
Source: Supplemental Figure 1 in the published paper.

Figure 3: 11 Countries from which 10 or more of the Studies Originated



Source: Figure 2 in the Supplemental Data of the published paper.

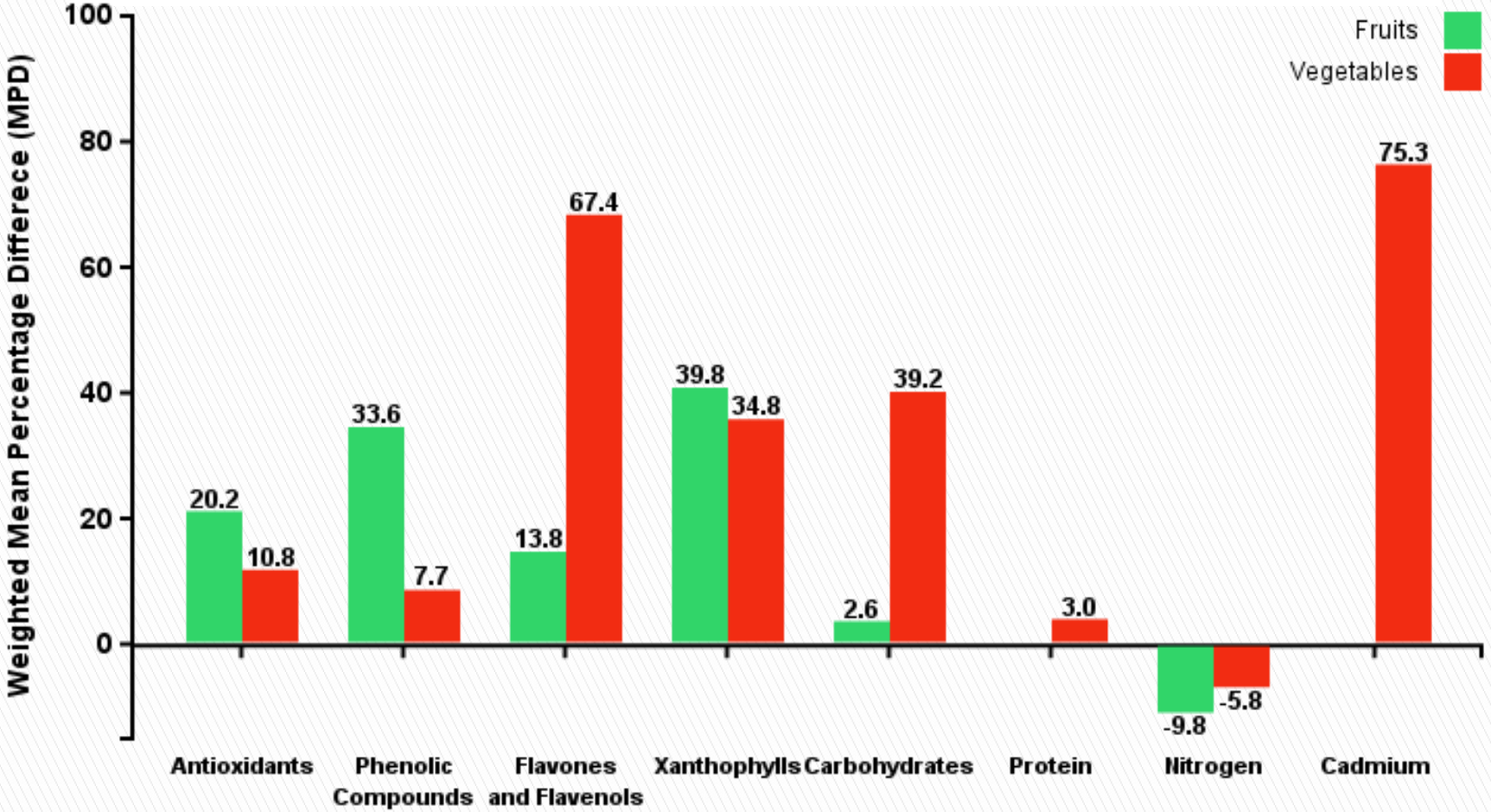
Antioxidants over 17% higher in organic – average across 286 fruits and vegetables analyzed



Baranski et al. *British Journal of Nutrition. 2014;112:794–811.*

Cadmium in Vegetables

Cadmium over 75% higher in conventional over organic



Source: Table 10 of the supplemental data in Baranski et al. *2014.*

Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses

Standard meta-analyses showed that the **frequency of occurrence of detectable pesticide residues was four times higher in conventional crops** (46 (95% CI 38, 55) %) **than in organic crops** (11 (95%, CI 7, 14) %).

Significantly higher frequencies of occurrence of pesticide residues in conventional foods were also detected in data reported for fruits, vegetables, and processed crop-based foods were analyzed separately.

Conventional fruits had a higher frequency (75 (95% CI 65, 85) %) of occurrence of pesticide residues than vegetables (32 (95% CI 25, 43) %) and crop-based compound foods (45 (95% CI 25, 65) %).

Baranski et al. *British Journal of Nutrition. 2014;112:794-811*

Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses

Summary: Results

Organic crops have, on average, significantly higher levels of antioxidants than conventional crops. Average total antioxidant activity was 17% higher in organic versus conventional crops.

- Nitrogen concentrations were found to be significantly lower in organically-grown than conventionally-grown crops.

- Pesticide residues were four times more likely to be found in conventional crops than organic crops.

- Substantially lower concentrations of the toxic metal cadmium was also detected in organic plant-based foods (on average, 48% lower).

Baranski et al. *British Journal of Nutrition. 2014;112:794-811*

Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses

Discussion:

For plant secondary metabolites, these results contradict results of systematic review/meta-analyses from Dangour et al. (2009) and Smith-Spangler et al. (2012).

The main reason for the inability of previous studies to detect composition differences was probably the highly limited number of studies/data sets available or included in these analyses, which would have decreased the statistical power of the meta-analyses.

In addition, most of the previous studies did not use weighted meta-analyses based on standard mean difference values (SMD).

Baranski et al. *British Journal of Nutrition. 2014;112:794-811*

Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses

Need for Additional Research:

"There is an urgent need for well-controlled human intervention and/or cohort studies to identify/quantify potential human health impacts of organic *v.* conventional food consumption."

Baranski et al. *British Journal of Nutrition. 2014;112:794-811*

Emerging Evidence – Organically-Produced Foods:

A cohort study on pregnant women in Norway found that reported consumption of organically grown vegetables during pregnancy was associated with reduced risk of pre-eclampsia (Torjusen et al. 2014).

- A case control study in Denmark found a higher likelihood of hypospadias in the offspring among women who never used organic high fat dairy foods compared with those who often used organic high fat dairy foods (Christensen et al., 2013).

- Children who consumed dairy products of which more than 90% were organically produced had a lower risk of eczema at age 2 than children who consumed dairy products of which less than 50% were organically produced (Kummeling et al., 2008).

Reduced risk of pre-eclampsia with organic vegetable consumption: results from the prospective Norwegian Mother and Child Cohort Study – *British Medical Journal Open*

(Published: October 2014)

Reference: Torjusen H, Brantsæter AL, Haugen M, et al. Reduced risk of preeclampsia with organic vegetable consumption: results from the prospective Norwegian Mother and Child Cohort Study. *BMJ Open* 2014;4:e006143. doi:10.1136/bmjopen-2014- 006143

Purpose:

The aim of the study was to examine associations between organic food consumption during pregnancy and the risk of pre-eclampsia among nulliparous Norwegian women.

Reference: Torjusen H, Brantsæter AL, Haugen M, et al. Reduced risk of preeclampsia with organic vegetable consumption: results from the prospective Norwegian Mother and Child Cohort Study. *BMJ Open* 2014;4:e006143. doi:10.1136/bmjopen-2014- 006143

Participants:

28,192 pregnant women (nulliparous) answered a food frequency questionnaire and general health questionnaire in mid-pregnancy and no missing information on height, body weight, or gestational weight gain).

Reference: Torjusen H, Brantsæter AL, Haugen M, et al. Reduced risk of preeclampsia with organic vegetable consumption: results from the prospective Norwegian Mother and Child Cohort Study. *BMJ Open* 2014;4:e006143. doi:10.1136/bmjopen-2014- 006143

Main Outcome Measure:

Relative risk was estimated by ORs by performing binary logistic regression with pre-eclampsia as the outcome and organic food consumption as the exposure.

Reference: Torjusen H, Brantsæter AL, Haugen M, et al. Reduced risk of preeclampsia with organic vegetable consumption: results from the prospective Norwegian Mother and Child Cohort Study. *BMJ Open* 2014;4:e006143. doi:10.1136/bmjopen-2014- 006143

Results:

Women who reported to have eaten organic vegetables 'often' or 'mostly' (n = 2,493, 8.8%) had lower risk of pre-eclampsia than those who reported 'never/rarely' or 'sometimes' have eaten organic vegetables [crude OR = 0.76, 95%, CI 0.61 to 0.96; adjusted OR = 0.79, 95% CI 0.62 to 0.99).

Reference: Torjusen H, Brantsæter AL, Haugen M, et al. Reduced risk of preeclampsia with organic vegetable consumption: results from the prospective Norwegian Mother and Child Cohort Study. *BMJ Open* 2014;4:e006143. doi:10.1136/bmjopen-2014- 006143

Results (cont'd):

- The lower risk association with high organic vegetable consumption was evident also when adjusting for overall dietary quality, assessed as scores on a healthy food pattern derived by principal component analysis.

- No associations with pre-eclampsia were found for high intake or organic fruit, cereals, eggs, or milk, or a combined index reflecting organic consumption.

Reference: Torjusen H, Brantsæter AL, Haugen M, et al. Reduced risk of preeclampsia with organic vegetable consumption: results from the prospective Norwegian Mother and Child Cohort Study. *BMJ Open* 2014;4:e006143. doi:10.1136/bmjopen-2014- 006143

Discussion:

Possible explanations of the research findings include:

- 1) lower dietary pesticide exposure; 2) higher intake of secondary plant metabolites; and 3) possibly a different microflora on organic vegetables, which could affect human (maternal) intestinal microbiota in a beneficial way.

- Pesticides, or the absence of them, might impact the composition of gut microbiota.

Reference: Torjusen H, Brantsæter AL, Haugen M, et al. Reduced risk of preeclampsia with organic vegetable consumption: results from the prospective Norwegian Mother and Child Cohort Study. *BMJ Open* 2014;4:e006143. doi:10.1136/bmjopen-2014- 006143

Conclusions:

- Increased consumption of plant food, including vegetables, is recommended to all pregnant women, and this study shows that choosing organically grown vegetables may yield additional benefits.

- Future studies are needed to confirm the observed association.

Reference: Torjusen H, Brantsæter AL, Haugen M, et al. Reduced risk of preeclampsia with organic vegetable consumption: results from the prospective Norwegian Mother and Child Cohort Study. *BMJ Open* 2014;4:e006143. doi:10.1136/bmjopen-2014- 006143

Environmental Benefits of Organic Farming:

- A recent meta-analysis examining the results from 94 different studies demonstrated, on average, organic farms support 34% higher species richness (plant, insect, and animal species) than conventional systems.

- This same analysis showed that for pollinators such as bees, species richness may be as much as 50% higher on organic farms.

Reference: Tuck S, et al. Land-use intensity and the effects of organic farming on biodiversity: a hierarchical meta-analysis. *Journal of Applied Ecology.* 2014. DOI: 10.1111/1365-2664.12219.

Pesticides Linked to Bird Declines –

Hallmann *et al.* (2014) have observed rapid declines in bird populations in regions with high environmental neonicotinoid pesticide concentrations, and suggest that they are the result of insect poisoning and depleting the birds' food supply – insects.

"When neonicotinoids are applied as a seed dressing to crops, the bulk of the active ingredient (80–98%) enter the soil and soil water."

"There, they can persist for long periods, accumulate, be taken up by the roots of vegetation at the margins of fields and follow-on crops, or leach into aquatic systems. Neonicotinoids are highly toxic to insects, which are exposed to chemicals in plants, soil and water."

Sources: Hallmann CA et al. Declines in insectivorous birds are associated with high neonicotinoid concentrations. *Nature*. 2014. doi: 10.1038/nature13531.

Goulson D. Pesticides linked to bird declines. *Nature.* 2014; doi:10.1038/nature13642

– Pete Myers

"Scientists are studying tree swallows to look for effects of neonics"

Winged Warnings – *Environmental Health News* and *National Geographic*. A new generation of scientists. Available at: http://www.environmentalhealthnews.org/ehs/news/2014/aug/a-new-generation-of-scientists

“Unfortunately for birds they’re the sentinels.”

“If we ignore what we see in birds we ignore real risk.”

–Dr. Linda Birnbaum, Director
National Institute of Environmental Health Sciences

A Review of the Direct and Indirect Effects of Neonicotinoids

- An analysis found that the most affected groups of species were terrestrial invertebrates such as earthworms which are exposed at high levels via soil and plants, medium levels via surface water and leaching from plants and low levels via air (dust).

- The next most affected group is insect pollinators such as bees and butterflies which are exposed to high contamination through air and plants and medium exposure through water.

Sources: IUCN – Systemic pesticides pose global threat to biodiversity and ecosystem services. June 24 2014. Available at: http://www.iucn.org/news_homepage/?16025/Systemic-Pesticides-Pose-Global-Threat-to-Biodiversity-And-Ecosystem-Services

The Task Force on Systemic Pesticides - http://www.tfsp.info

A Review of the Direct and Indirect Effects of Neonicotinoids (cont'd)

- Use of imidacloprid and clothianidin (neonotinoids) as seed treatments on some crops poses risks to small birds, and ingestion of even a few treated seeds could cause mortality or reproductive impairment to sensitive bird species.

- "Neonicotionid insecticides (and fipronil) can exert their impact on vertebrate either directly, through their overt toxicity, or indirectly, for example, by reducing their food supply."

Sources: Gibbons D, et al. A review of the direct and indirect effects of neonicotinoids and fipronil on vertebrate wildlife. *Environ Sci Pollut Res*. 2014. DOI 10.1007/s11356-014-3180-5.

IUCN – Systemic pesticides pose global threat to biodiversity and ecosystem services. June 24 2014. Available at: http://www.iucn.org/news_homepage/?16025/Systemic-Pesticides-Pose-Global-Threat-to-Biodiversity-And-Ecosystem-Services

The Task Force on Systemic Pesticides – http://www.tfsp.info

A Review of the Direct and Indirect Effects of Neonicotinoids (cont'd)

- "There remains an essential need to determine if a causal link between loss of insect prey through pesticide use and the decline of vertebrate populations exists. This is especially true in North America and Europe where neonicotinoids are being used in large quantities and over vast areas."

Source: Gibbons D, et al. A review of the direct and indirect effects of neonicotinoids and fipronil on vertebrate wildlife. *Environ Sci Pollut Res*. 2014. DOI 10.1007/s11356-014-3180-5.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington, D.C. 20240

July 17, 2014

Memorandum

To: Regional Refuge Chiefs, Regions 1-8

From: Chief, National Wildlife Refuge System James W. Kurth

Subject: Use of Agricultural Practices in Wildlife Management in the National Wildlife Refuge System

This Memorandum records the decision of the National Wildlife Refuge System Leadership Team (Leadership Team) regarding the use of agricultural practices for wildlife management on national wildlife refuges. On May 21, 2014, we concluded discussion about current agricultural practices across the National Wildlife Refuge System (System) to meet refuge objectives, the use of genetically engineered crop seeds, and the use of pesticides.

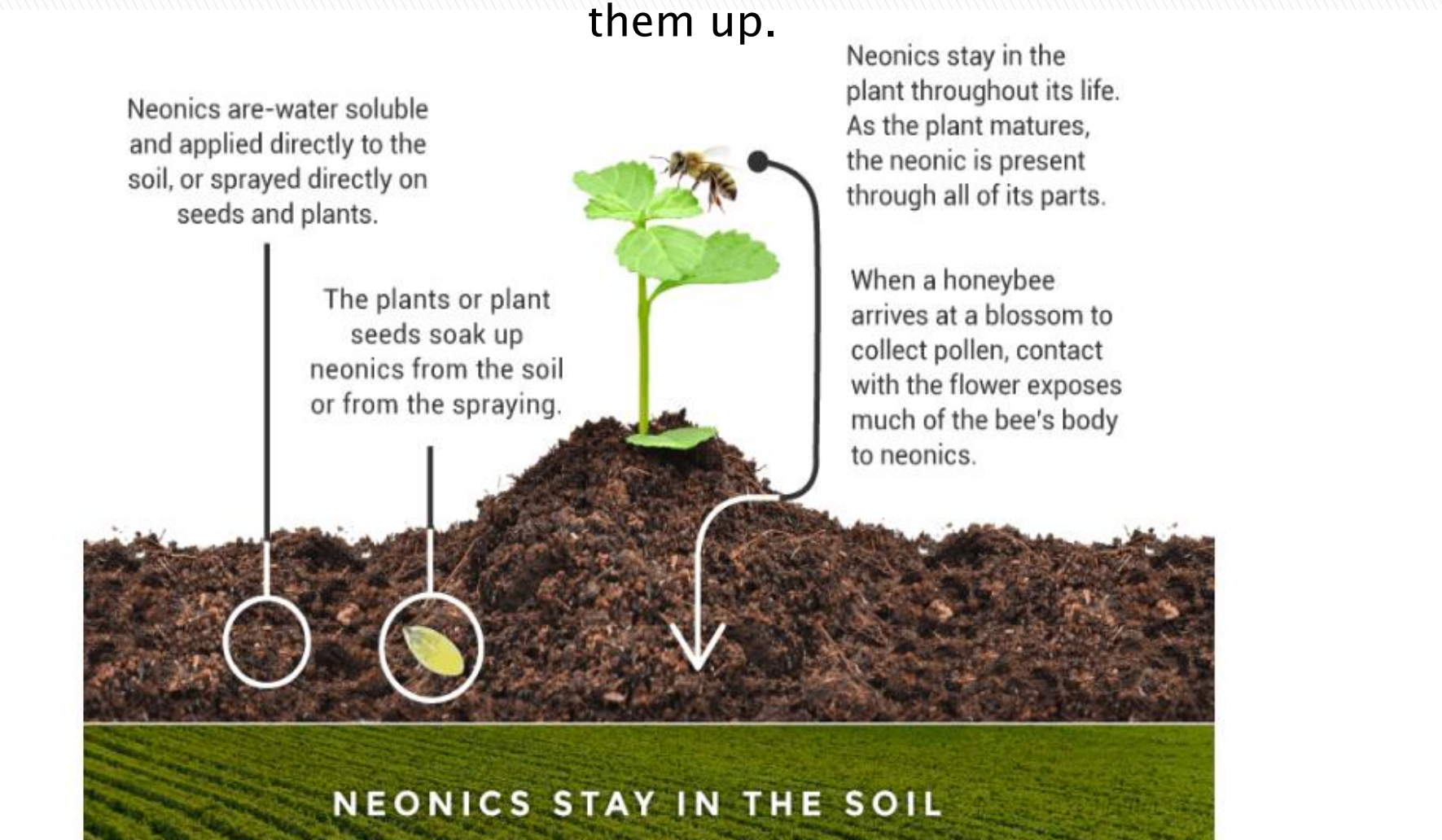
The Leadership Team agreed that by January 2016, the System will only use an agricultural practice where it specifically contributes to wildlife objectives. This conforms to 601 FW 3, the Service's Biological Integrity, Diversity and Environmental Health policy (BIDEH). BIDEH directs us to maintain and restore the biological integrity, diversity, and environmental health of refuges and is based on the underlying principle of wildlife conservation that favors management that restores or mimics natural ecosystem processes or functions to achieve refuge purpose(s).

By January 2016, we will no longer use neonicotinoid pesticides in agricultural practices used in the System. Service policy 569 FW 1 Pest Management directs that we use long-standing integrated pest management principles to guide and evaluate our pesticide use practices. We have determined that prophylactic use, such as a seed treatment, of the neonicotinoid pesticides that can distribute systemically in a plant and can potentially affect a broad spectrum of non-target species is not consistent with Service policy. We make this decision based on a precautionary approach to our wildlife management practices and not on agricultural practices.

Neonicotinoid Pesticides: Stay in the Soil

http://earthjustice.org/features/infographic-bees-toxic-problem

Because neonicotinoids are used as soil treatment, they can remain in the soil for years, and new plantings of crops will soak them up.



‘Having a Picnic Without Bees’

http://earthjustice.org/features/infographic-bees-toxic-problem

"EPA Announces Moratorium on New Uses of Bee-Killing Pesticides, Coalition Urges Broader Suspension"

"We need EPA to protect bees and other pollinators from the neonicotinoids and other bee-harming insecticides that are already covering corn and soybean acres in our area, not just keep new products off the market" – Johanna Voight, Program and Communications Coordinator at Kansas Rural Center.

"Here at the Kansas Rural Center we work with farmers who rely on pollinators to cultivate crops like squash, blueberries, apples, cucumbers, peppers, sunflowers, and more."

Source: EPA Announces Moratorium on New Uses of Bee-Killing Pesticides. Coalition Urges Broader Suspension. *Beyond Pesticides.* April 3, 2015. Available at: http://www.beyondpesticides.org/dailynewsblog/?p=15334

Do Pollinators Contribute to Nutritional Health?

The authors present results of the first empirical test of how pollinators influence nutrient intake and risk of nutrient deficiency.

The authors focused their analyses on children and women in developing countries (Zambia, Uganda, Mozambique, and Bangladesh) where high rates of malnutrition and limited access to nutrient supplements make individuals more susceptible to the effects of pollinator declines.

References:

Ellis AM, Myers SS, Ricketts TH. Do Pollinators Contribute to Nutritional Health? *PLoS ONE* 2015;10(1): e114805. doi:10.1371/journal.pone.0114805.

Do Pollinators Contribute to Nutritional Health?

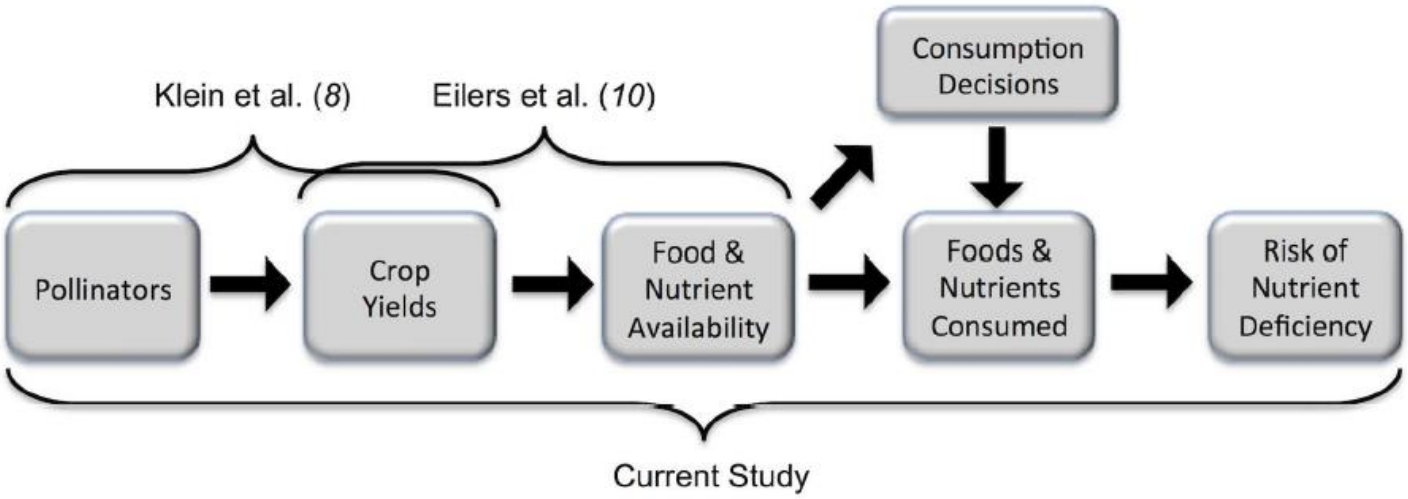


Fig. 1. Conceptual framework of the influence of pollinators on risk of nutrient deficiency. Klein et al. [8] studied the first arrow and Eilers et al. [10] studied the second. Our study builds on these to examine the complete causal pathway.

Reference:

Ellis AM, Myers SS, Ricketts TH. Do Pollinators Contribute to Nutritional Health? *PLoS ONE* 2015;10(1): e114805. doi:10.1371/journal.pone.0114805.

Do Pollinators Contribute to Nutritional Health?

Findings:

- The role of pollinators in determining nutrient intake varied widely among nutrients and countries.

- 69 percent or more of the vitamin A in children's diets came from fruits and vegetables, many of which depend on pollinators.

- In four countries and across five nutrients, 0 to 56% of populations would become newly at risk if pollinators were removed.

Reference:

Ellis AM, Myers SS, Ricketts TH. Do Pollinators Contribute to Nutritional Health? *PLoS ONE* 2015;10(1): e114805. doi:10.1371/journal.pone.0114805.

Do Pollinators Contribute to Nutritional Health?

Conclusion:

- The importance of pollinators to human nutrition depends critically on the composition of local diets, and cannot be predicted reliability from global commodity analyses.

Reference:

Ellis AM, Myers SS, Ricketts TH. Do Pollinators Contribute to Nutritional Health? *PLoS ONE* 2015;10(1): e114805. doi:10.1371/journal.pone.0114805.

Do Pollinators Contribute to Nutritional Health?

The “hidden hunger” associated with vitamin and mineral deficiencies is estimated to harm more than 1 in 4 people around the globe, contributing to the risk of many diseases, reduced IQ, and diminished work productivity.

“Continued declines of pollinator populations could have drastic consequences for global public health.”

References:

Ellis AM, Myers SS, Ricketts TH. Do Pollinators Contribute to Nutritional Health? *PLoS ONE* 2015;10(1): e114805. doi:10.1371/journal.pone.0114805.

With pollinator declines, millions at risk of malnutrition. University of Vermont. January 26th 2015. Available at: http://www.eurekalert.org/pub_releases/2015-01/uov-wpd012615.php

Do Pollinators Contribute to Nutritional Health?

"The take home is: pollinator declines can really matter to human health, with quite scary numbers for Vitamin A deficiencies… - says UVM scientist Taylor Ricketts - who co-led the new study - "which can lead to blindness and increase death rates for some diseases including malaria."

References:

Ellis AM, Myers SS, Ricketts TH. Do Pollinators Contribute to Nutritional Health? *PLoS ONE* 2015;10(1): e114805. doi:10.1371/journal.pone.0114805.

With pollinator declines, millions at risk of malnutrition. University of Vermont. January 26th 2015. Available at: http://www.eurekalert.org/pub_releases/2015-01/uov-wpd012615.php

Yield versus the Environment?

"As others have pointed out, agricultural yields, in and of themselves, are not sufficient to address the twin crises of hunger and obesity, both associated with poverty, that are seen in the world today. Current global caloric production greatly exceeds that need to supply the world's population, yet social, political, and economic factors prevent many people from accessing sufficient food for a healthy life."

Reference: Ponisio LC, M'Gonigle LK, Mace KC, Palomino J, de Valpine P, Kremen C. Diversification practices reduce organic to conventional yield gap. *Proc. R. Soc. B*. 2015;282:20141396. http://dx.doi.org/10.1098/rspb.2014.1396

Yield versus the Environment? (cont'd)

'A sole focus on increased yields will not solve the problem of world hunger. Increased production is, however, critical for meeting economic needs of poor farmers who make up the largest portion of the world's chronically hungry people, and agro-ecological methods provide low cost methods for doing so (e.g., Khan et al., 2011) (Ponisio et al., 2015).'

Further, environmentally sustainable, resilient production systems will become an increasingly urgent necessity in a world where many planetary boundaries have been reached or exceeded (Ponisio et al., 2015)

References: Ponisio LC, M'Gonigle LK, Mace KC, Palomino J, de Valpine P, Kremen C. Diversification practices reduce organic to conventional yield gap. *Proc. R. Soc. B*. 2015;282:20141396.

Khan Z, Midega C, Pittchar J. Push-pull technology: a conservation agriculture approach for integrated approach for integrated management of insect pests, weeds, and soil health in Africa: UK Government's foresight food and farming futures project. *In. J. Agric. Sustain*. 2011;9:162-170.

2015 Agricultural Development Prize Given to "Push-Pull" Lead Scientist – Prof. Zeyaur Khan

References: 2015 Agricultural Development Prize Given to "Push-Pull" Lead Scientist – Prof. Zeyaur Khan. March 17th 2015. Available at: http://icipe.org/index.php/news/914-major-international-prize-to-push-pull-lead-scientist-icipes-prof-zeyaur-khan.html

Khan Z, Midega C, Pittchar J. Push-pull technology: a conservation agriculture approach for integrated management of insect pests, weeds, and soil health in Africa: UK Government's foresight food and farming futures project. *In. J. Agric. Sustain*. 2011;9:162-170.

‘2015: International Year of Soils’

2015
International
Year of Soils

"We speak a lot of the importance of sustainable food systems for healthy lives. Well, it starts with soils."
– José Graziano da Silva, FAO Director-General

Source: http://www.fao.org/soils-2015/en/

Pesticide Exposure:
Risk to Farm Families & the Community

- Exposure to organochlorine pesticides and certain organophosphate pesticides was associated with an increased risk of diabetes among wives of farmers in the Agricultural Health Study [Iowa and North Carolina] (Starling et al., 2014).

- Exposure of certain pesticides may increase risk of developing Parkinson's disease by two to six times for people with genetic vulnerability to the pesticides' effect on enzyme function (Fitzmaurice et al., 2014).

Reference: Hunger and Environmental Nutrition (HEN) Dietetic Practice Group (DPG) Organic Talking Points, September 2014. Available at: http://www.hendpg.org/page/organic-talking-points

US Farmworkers and Pesticides

Pesticide Lake:
The Poisoning of the Workers of Apopka, Florida

http://earthjustice.org/video/pesticide-lake-the-poisoning-of-the-workers-of-apopka-florida

RD/RDN/DTR Resources:

-- *HEN Organic Talking Points (3rd edition),* Hunger and Environmental Nutrition Dietetic Practice Group, September 2014

Available at: http://www.hendpg.org/page/organic-talking-points

-- *From Crop to Table: Pesticide Use in Produce:*
Consumer Reports Food Safety & Sustainability Center, March 2015
Available at:
http://www.consumerreports.org/content/dam/cro/magazine-articles/2015/May/Consumer%20Reports_From%20Crop%20to%20Table%20Report_March%202015.pdf

President's Cancer Panel Report (Annual Report 2008-2009), Reducing Environmental Cancer Risk: What We Can Do Now , US DHHS, National Institutes of Health, National Cancer Institute, Washington DC, April 2010. Available at:
http://deainfo.nci.nih.gov/advisory/pcp/annualReports/pcp08-09rpt/PCP_Report_08-09_508.pdf

HEN DPG Organic Talking Points

(3rd Edition, September 2014)

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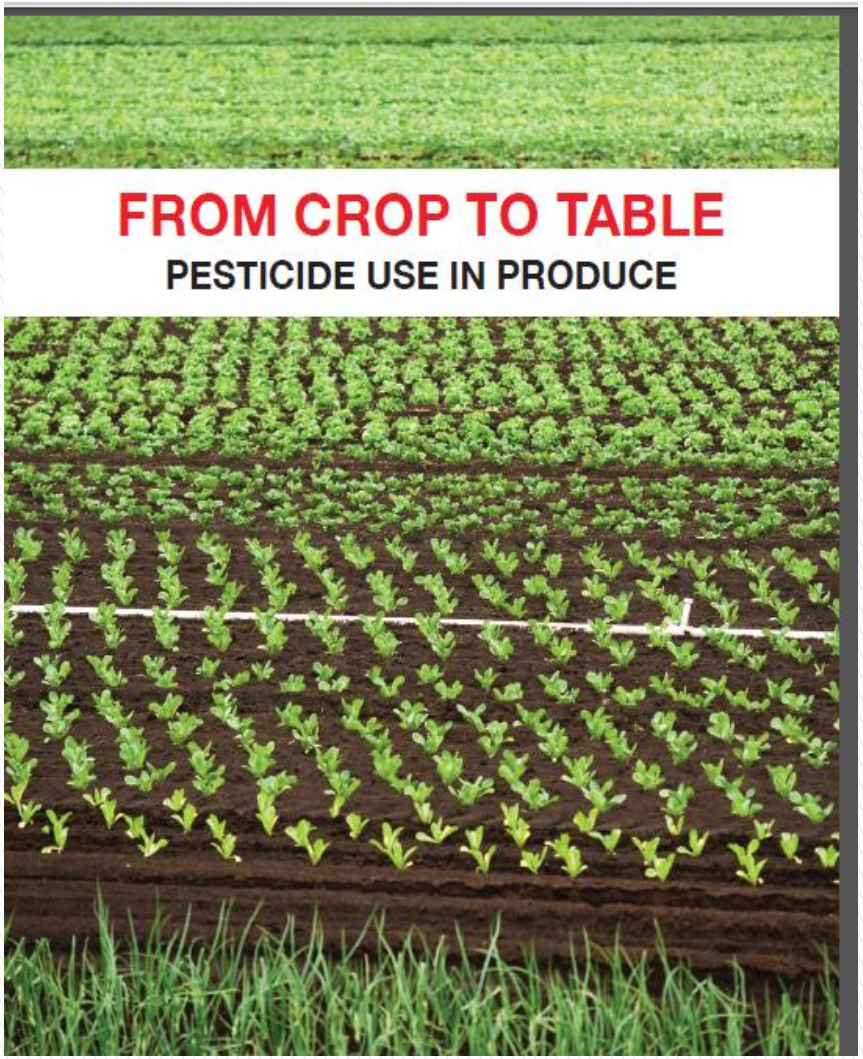
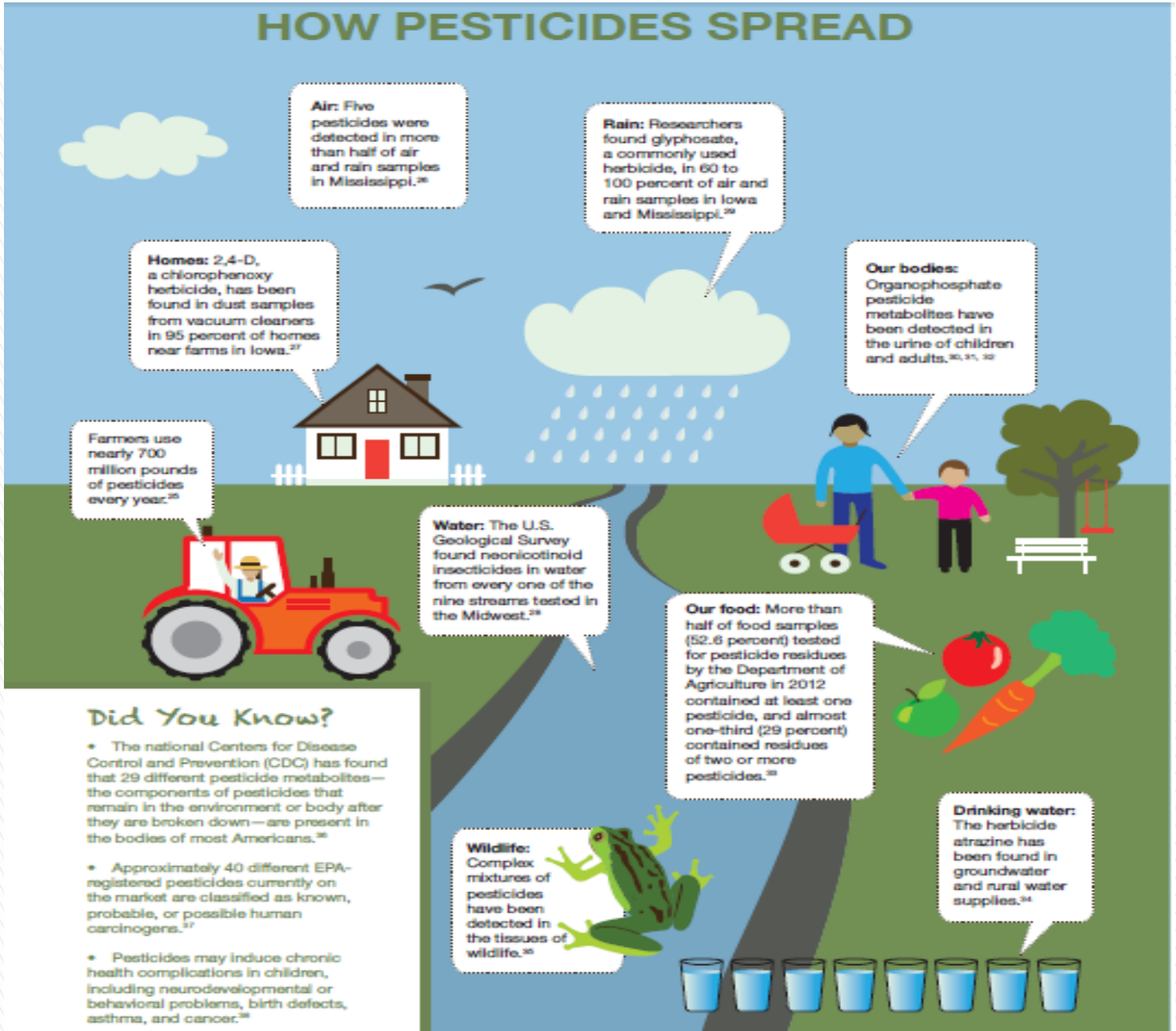


Reference: Rangan, U, Crupain M, Sullivan D. et al. ***From Crop to Table: Pesticide Use in Produce.*** Consumer Reports, Food Safety & Sustainability Center. March 2015.

Consumer Reports – FROM CROP TO TABLE (March 2015)



Source: Consumer Reports
From Crop to Table: Pesticides in Produce (March 2015)

Air and Rain: Five pesticides were detected in more than half of air and rain samples in Mississippi. Researchers found glyphosate, a commonly used herbicide, in 60 to 100 percent of rain samples in Iowa and Mississippi.

Water: The US Geological Survey found neonicotinoid insecticides in water from every one of the nine streams tested in the Midwest.

Our Food: More than half of the samples (52.6 percent) tested for pesticide residues by the US Dept. of Agriculture in 2012 contained at least one pesticide, and almost a third (29 percent) contained residues of two or more pesticides.

Drinking water: Atrazine (herbicide) has been found in groundwater and rural water supplies.

Wildlife: Complex mixtures of pesticides have been detected in the tissues of wildlife.

Pesticides are designed to be toxic to living organisms.

☛ **Rural residents.** 2,4-D and other chlorophenoxy herbicides are listed as 2B carcinogens, "possibly carcinogenic to humans."[206] Studies show an association between cancer mortality and living near farm fields treated with the herbicide 2,4-D.[207]

☛ **Honeybees**. Neonicotinoids are linked to honeybee colony collapse disorder.[208] Nearly one-third of managed honeybee colonies were lost during the winter of 2012 to 2013.[209]

☛ **Monarch butterflies**. Glyphosate kills the milkweed plant, the primary food of monarch butterflies. Monarch butterfly populations have declined drastically over the past decade.[210]

☛ **Children**. Organophosphate pesticide exposure has been linked to deficits in IQ,[211] attention,[212] and behavioral development in children.

☛ **Rural residents.** Atrazine is a suspected endocrine disruptor, which may affect reproductive health and children's sexual development.[213]

☛ **Turtles.** The eggs of snapping turtles die when they are laid in a field treated with the common soil fumigant metam sodium.[214]

☛ **Farmers.** High pesticide exposure among farmers has been linked to prostate and ovarian cancer,[215] lung cancer,[216] stomach cancer,[217] hypothyroidism,[218] changes in memory and attention,[219] and increased respiratory disease.[220]

☛ **Birds**. An estimated 72 million wild birds die each year from pesticide exposure.[221]

☛ **Farmworkers.** 10,000 to 20,000 physician-diagnosed pesticide poisonings occur each year among farmers and farmworkers.[222]

Organic: Farming Without Pesticides

Federal law prohibits the use of almost all synthetic pesticides on organic farms.

- There are currently no synthetic herbicides approved for use on organic food crops.[223]
- All neonicotinoids are prohibited on organic farms.
- The herbicide glyphosate is prohibited on organic farms.
- All organophosphate pesticides are prohibited on organic farms.
- Only 10 synthetic insecticides are approved for use on organic farms. Some can be used only if they do not come into direct contact with soil or crops (e.g., as bait traps).[224]
- The herbicide atrazine is prohibited on organic farms.
- Synthetic soil fumigants are prohibited on organic farms.
- Biodiversity is richer in organic than conventional farm fields.[225]
- Children who eat organic fruits and vegetables have fewer pesticide residues in their bodies compared with children who eat conventional fruits and vegetables.[226]

Reference: Rangan, U, Crupain M, Sullivan D. et al. *From Crop to Table: Pesticide Use in Produce.* Consumer Reports, Food Safety & Sustainability Center. March 2015.

Reducing Exposure to Pesticides

What Consumers Can Do?

Consumer Reports Residue Guide –

Based on the Dietary Risk Index (DRI)

Dietary Risk Index – a measure that allows for the comparison of the relative non-cancer risks of pesticide exposures from different food sources, risk trends over time, and differences in relative risk levels in domestically produced vs. imported foods.

Reference: Rangan, U, Crupain M, Sullivan D. et al. ***From Crop to Table: Pesticide Use in Produce.*** Consumer Reports, Food Safety & Sustainability Center. March 2015; p. 25.

Dietary Risk Index (DRI) depends on:

EPA-recommended pesticide dietary risk assessment methods and takes into account:

- The amount and frequency of residues on a given food, as reported in annual Department of Agriculture pesticide residue-testing results.
- The typical serving size of that food.
- The weight of the person consuming that food.
- The toxicity of the pesticide as determined by the Environmental Protection Agency.

Reference: Rangan, U, Crupain M, Sullivan D. et al. ***From Crop to Table: Pesticide Use in Produce.*** Consumer Reports, Food Safety & Sustainability Center. March 2015; p. 25.

Comparing *Consumer Reports* (CR) Guide with The Environmental Working Group's Shopper's Guide to Pesticides in Produce™

CR's advice:

- takes into account the number of residues per sample, the average level of each residue, the frequency of finding it, the serving size, and the toxicity of each pesticide.

- adheres closely to recommended EPA dietary risk assessment policies.

Reference: Rangan, U, Crupain M, Sullivan D. et al. *From Crop to Table: Pesticide Use in Produce.* Consumer Reports, Food Safety & Sustainability Center. March 2015; p. 27.

Comparing *Consumer Reports* (CR) Guide with The Environmental Working Group's Shopper's Guide to Pesticides in Produce™

CR's advice:

- provides more complete information to consumers about differences in the risks associated with pesticides in domestically grown food, compared with imported food.

- integrates non-cancer as well as cancer risks.

Reference: Rangan, U, Crupain M, Sullivan D. et al. *From Crop to Table: Pesticide Use in Produce.* Consumer Reports, Food Safety & Sustainability Center. March 2015; p. 27.

Fruits

	Risk Level [1]					You Can Choose Conventional If It's From:	Beware of Conventional If It's From:	Always Buy Organic
	Very Low	Low	Med.	High	Very High			
Peaches				■			Chile, U.S.	✔
Tangerines				■			Chile, South Africa, U.S.	✔
Plums		■		■		U.S.	Chile	
Nectarines			■	■			U.S., Chile [2]	✔
Apples		■		■		New Zealand	U.S.	
Strawberries				■			U.S.	✔
Cantaloupe	■	■		■		Honduras, Mexico, Costa Rica, Guatemala [2]	U.S.	
Cranberries			■				U.S.	✔
Mangoes	■	■	■			Mexico, Guatemala [2]	Brazil	
Pears		■				Argentina, U.S.		
Oranges		■				Chile, South Africa, U.S.		
Cherries		■				U.S.		
Grapefruit		■				U.S.		
Watermelon	■	■				Guatemala, Honduras, Mexico, U.S. [2]		
Blueberries	■	■				Uruguay, Argentina, Canada, Chile, U.S. [2]		
Grapes		■				Chile, Mexico, Peru, U.S.		
Raspberries		■				Mexico, U.S.		
Bananas		■				Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Mexico		
Papaya	■					Belize, Brazil, Guatemala, Jamaica, Mexico, U.S.		
Pineapples	■					Costa Rica, Ecuador, Mexico, U.S.		

Source: *Consumer Reports* – Food Safety and Sustainability Center (2015)

Vegetables

	Risk Level [1]					You Can Choose Conventional If It's From:	Beware of Conventional If It's From:	Always Buy Organic
	Very Low	Low	Med.	High	Very High			
Green Beans			■	■	■		Guatemala, Mexico, U.S. [2]	✔
Sweet Bell Peppers				■	■		U.S., Mexico [2]	✔
Hot Peppers				■	■		U.S., Mexico [2]	✔
Winter Squash	■	■		■		Guatemala, Honduras, Mexico [2]	U.S.	
Cucumbers		■		■		Canada	Mexico, U.S.	
Summer Squash		■		■		Mexico	U.S.	
Snap Peas		■		■		Mexico, U.S.	Guatemala, Peru	
Tomatoes		■	■	■		Canada	U.S., Mexico [2]	
Sweet Potatoes				■			U.S.	✔
Cherry Tomatoes		■		■		U.S.	Mexico	
Celery	■		■			Mexico	U.S.	
Carrots			■				Canada, Mexico, U.S.	✔
Kale		■	■			Mexico	U.S.	
Potatoes		■	■			Canada	U.S.	
Asparagus	■	■	■			Mexico, U.S. [2]	Peru	
Eggplant	■	■	■			Honduras, U.S. [2]	Mexico	
Lettuce		■				Mexico, U.S.		
Spinach	■	■				Mexico, U.S. [2]		
Collard Greens		■				U.S.		
Cauliflower		■				Mexico, U.S.		
Cilantro	■	■				U.S., Mexico [2]		
Green Onions	■	■				Mexico, U.S. [2]		
Broccoli	■	■				U.S., Mexico [2]		
Mushrooms	■	■				Canada, U.S. [2]		
Cabbage	■					Canada, Mexico, U.S.		
Corn	■					Mexico, U.S.		
Avocado	■					Chile, Mexico, Peru		
Onion	■					Peru, U.S.		

Fruits – Always Choose Organic
Dietary Risk Index – DRI, *Consumer Reports* (2015)

1. Peaches
2. Tangerines
3. Nectarines
4. Strawberries**
5. Cranberries

Source: ***Consumer Reports*** – Food Safety and Sustainability Center (2015)

** does not address social justice issues such as worker pay or working conditions.

Vegetables – Always Choose Organic

Dietary Risk Index – DRI, *Consumer Reports* (2015)

1. Green Beans
2. Sweet Bell Peppers
3. Hot Peppers
4. Sweet Potatoes
5. Carrots

Source: ***Consumer Reports*** – Food Safety and Sustainability Center (2015)

Stretching Your Produce & Organic Food Dollar

From Crop To Table: Pesticide Use in Produce
Consumer Reports (March 2015)

-- Buy Whole Foods and Process at Home
-- Buy in Bulk
-- Buy in Season
(e.g., find a farmers' market, join a community supported agriculture farm)
-- Buy Frozen or Dried
-- Replace Processed Snack Foods (e.g., cookies, chips) with Organic Fruits & Vegetables

Source: *Consumer Reports* – Food Safety and Sustainability Center (2015)

Summary: Benefits of Organically-Produced Foods:

- Organic crops have, on average, significantly higher levels of antioxidants than conventional crops. Average total antioxidant activity was 17% higher in organic versus conventional crops.

- Pesticide residues were four times more likely to be found in conventional crops than organic crops.

- Substantially lower concentrations of the toxic metal cadmium was also detected in organic plant-based foods.

Summary: Benefits of Organically-Produced Foods (cont'd):

- Reduced risk of exposure to synthetic pesticides in high risk populations (e.g., farmers, farmworkers, rural residents, pregnant women, infants, and children).

- Long-term benefits to the environment and biodiversity (i.e., enhanced species richness).

Food for Thought –

In 1962, Rachel Carson's book ***Silent Spring*** was published. Here, she wrote:

"These sprays, dusts, and aersols are now applied most universally to farms, gardens, forests, and homes – nonselective chemicals that have power to kill every insect, the 'good' and the 'bad,' to still the song of birds and leaping fish in the streams…"

Food for Thought –

"Carson was describing the environmental devastation caused by the over-reliance on and overuse of organochlorine insecticides such as DDT (dichlorodiphenyltrichloroethane) in the 1950s and 1960s, which led to major problems with outbreaks of pesticide-resistant pests, widespread contamination of the environment and knock-on effects through the food chain, including chronic poisoning of people. She would undoubtedly think that we seem to have learnt little from our past mistakes."

Source: Goulson D. Pesticides linked to bird declines. *Nature.* 2014; doi:10.1038/nature13642

THANK YOU!