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GLYPHOSATE

Pollinator Habitat Is Disappearing At Rates Usually Reserved For Descriptions of Amazon Rain Deforestation

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If we are to address two of the four **honey bee health concerns** - pesticides and poor forage (pests, and pathogens being the other two concerns) we must address the use of glyphosate. Research is showing it has sub-lethal effects, damages beneficial bacteria, persists or drifts from one crop to the next, and destroys pollinator forage. Crops can be protected from invasive plants, pollinators can be provided diverse natural forage, and crop yields will be increased due to increased healthy pollinators, but glyphosate use must be part of the discussion of pollinator health. Research has shown crop yields increase with **native pollinators**, and honey bee health is improved when diverse forage is available while pollinating a crop. Blueberries in New Jersey can see an increase in gross revenues of $112 per acre if one acre of vacant land is available to native pollinators. When blueberries were pollinated by more than one species of bees there was an increase of $311 worth of yield per acre in North Carolina. **A variety of crops see yield increases when wild pollinators and their habitat are near crops:**

Crop yield increase from wild pollinators:
squash 81%
tomatoes 18%
blueberries 10%
bell peppers 10%
watermelons 10%
peaches 9%
apples 9%
cucumbers 9%
cantaloupes 8%
soybeans 5%

However, across the United States, **"pollinator habitat is disappearing at rates usually reserved for descriptions of Amazon rain forest deforestation.** This is most striking in the Midwest where more than 36,000 square miles of wetlands and prairie – an area larger than Indiana – has been converted to cropland since 2008." Researchers compiled a graph showing the interdependence of pollinators and flowering plants in an Illinois forest fragment. The comparison graph shows a "dramatically shrunken web of relationships."

"**We are losing 6,000 acres of potential monarch/pollinator habitat a day in the United States due to development (2.2 million acres per year).** The losses of habitat due to the adoption of glyphosate tolerant corn and soybeans in the last 10 years amount to at least 100 million acres. The conversion of seven million acres of Conservation Reserve Program (CRP) land to crops for the production of biofuels adds to the total. In all, we estimate the loss of habitat to be 147 million acres since Monarch Watch was started in 1992 – an area four times the state of Illinois." (www.monarchwatch.org)

Glyphosate (N-Phosphonomethyl glycine) is the most widely used herbicide in the United States. About 100 million pounds are applied to U.S. farms and lawns every year, according to the EPA. First registered for use in the U.S. in 1974, more than 750 products contain glyphosate for the control of broadleaf weeds and grasses in: hay/pasture, soybeans, field corn; ornamentals, lawns, turf, forest plantings, greenhouses, rights-of-way.

The sodium salt form of glyphosate is used to regulate plant growth and ripen fruit.

Glyphosate is a non-selective herbicide, meaning it will kill most plants. It prevents the plants from making certain proteins that are needed for plant growth. Glyphosate stops a specific enzyme pathway, the shikimic acid pathway. The shikimic acid pathway is found only in plants and some microorganisms. This pathway is found in bacteria, however, and humans depend on bacteria in the gastrointestinal (GI) tract to synthesize the essential amino acids. Studies of chickens and cattle exposed to glyphosate "found that beneficial bacteria were susceptible, and harmful bacteria were resistant, to glyphosate." Researchers concluded glyphosate "disturbs the normal microbial community" predisposing chickens to Salmonella, and cattle to Clostridium botulinum.

Due to the development of glyphosate resistant crops, the use of glyphosate has increased. Research has shown the residues of glyphosate are found in the main foods of the Western diet. The research reported in Entropy discusses glyphosate's inhibition of cytochrome P450 (CYP) enzymes which play a crucial role in detoxifying xenobiotics. Thus, glyphosate enhances the damaging effects of other food borne chemical residues and environmental toxins. Its effects are insidious, because the long-term effects are often not immediately apparent. Glyphosate is likely to be pervasive in our food supply, and, contrary to being essentially nontoxic, it may in fact be the most biologically disruptive chemical in our environment.

Glyphosate binds to the soil with a half-life of 47 to 174 days in soil and 70-84 days in water. Another study found that some glyphosate was taken up by carrots and lettuce after the soil was treated with it. **Glyphosate is not just used to kill weeds, but sprayed on crops to kill the foliage just before harvest.** This pre-harvest crop desiccation is used to even ripening, to harvest the crop sooner, for weed control in the next crop, and to reduce green material in the harvest putting less strain on harvesting machinery. A variety of crops may have pre-harvest desiccation applications including, cereals, sunflower, kiwi, raspberries, soy, and alfalfa to name a few.

Most research has examined glyphosate alone, rather than combined with the inert ingredients. Inert ingredients are beginning to be defined as "other ingredients," as research is finding the inert ingredients are not the textbook definition of inert. (not able to affect other chemicals when in contact with them: not chemically reactive) Scientists found inert ingredients with glyphosate "amplified the toxic effect on human cells – even at concentrations much more diluted than those used on farms and lawns." One inert ingredient, polyethoxylated tallowamine (POEA), derived from animal fat, is a surfactant and used to aid the herbicide so it can "penetrate plants' surfaces, making the weed killer more effective." "POEA lowers water's surface tension - the property that makes water form droplets on most surfaces - which helps glyphosate disperse and penetrate the waxy surface of a plant."

In one study the researchers studied multiple concentrations ranging from the typical agricultural or lawn dose down to concentrations 00,000 times more dilute than the products sold on shelves. The researchers saw cell damage at all concentrations.

U.S. Geological Survey (USGS) scientists report that glyphosate, known commercially by many trade names, and its degradation product AMPA (aminomethyl phosphonic acid), are transported off-site from agricultural and urban sources and occur widely in the environment. The study summarized the results of 3,732 environmental samples collected between 2001 and 2010 from 38 states. . . the results indicate that glyphosate and AMPA frequently add to the chronic low-level exposures to mixtures of pesticides and pesticide degradation products that plants and animals experience in a wide range of ecosystems in the United States.

Glyphosate was detected in more than 50 percent of soil and sediment samples, and water samples from ditches and drains, precipitation, large rivers, and streams. Glyphosate was detected in less than 40 percent of water samples from lakes, ponds, wetlands. . . . AMPA was detected in more than 80 percent of wastewater treatment plant samples, while glyphosate was detected in only about 10 percent of those samples. The researchers noted stated the AMPA and glyphosate detection frequency, median concentrations increased the last four years of the study. Many studies continually showed the occurrence of herbicides in streams, the degradates of the herbicide were more common than the parent compound.

To meet national initiatives of increased pollinator forage, we can look to the lessons of the 1930s. The main lesson learned from the Dust Bowl was to “take care of the land.” Conserving soil, and maintaining/increasing soil fertility was key to stopping erosion, and improving crop yields. After the Dust Bowl government programs encouraged farmers to rotate crops and renew soil nutrients, to follow the contour of the land when plowing, to terrace sloping land to prevent erosion, and to plant rows of trees in “shelter belts” to slow wind erosion. These “shelter belts” became habitats for pollinators providing diverse food, and helping to increase crop yields through increased pollination service provided by native bees. We can compare the maps of glyphosate use, bee forage, and monarch migration and examine how we are affecting the food supply of the managed and native pollinators who pollinate our food supply.