

Monarchs Talk

I. Introduction and Thank You's

- Good evening, and welcome.
- Before getting started, I'd like to thank each of you for being here tonight. It's a real privilege to have the opportunity to speak with you about an issue that is close to my heart.
- **[Slide: monarch]** The monarch butterfly is a remarkable species that has inspired awe and wonder throughout the centuries. In the 1600s, the early colonial settlers in America were captivated by the monarch's striking beauty. They noted the distinctive orange and black patterning on the monarch's wings and decided to name the insect after William the III **[Slide: King William III]**, Prince of Orange, and later monarch of England, because they were so impressed by the butterfly's regal appearance. Since that time, monarchs have thrilled generations of Americans who have witnessed the butterflies on their annual journey across the United States. Countless schoolchildren have held monarch caterpillars in their hands while studying metamorphosis and life cycles in school. And both children and adults have marveled at how such a fragile insect, weighing only about half a gram, can traverse such vast distances, undertaking what is the longest insect migration known to mankind.
- But the monarch is also a species in trouble. Since the late 1990s, the monarch population has plummeted by over ninety percent. **[Slide: Graph showing monarch decline]** As I'll discuss in more detail later, this dramatic decline has, in recent years, been predominantly driven by the use of pesticides containing the chemical glyphosate—also known as Roundup—in the United States.
- As an attorney at the Natural Resources Defense Council (the NRDC), I work on lawsuits to protect monarchs, as well as other species and human health. As part of that work, I've gathered stories from people across the country who have witnessed the monarch's precipitous decline over the years. One woman with whom I spoke, recounted that when she was growing up in the Midwest in the 1950s and 60s, there were so many monarchs, that during peak migration season, the butterflies would darken the skies as they flew by. She could walk outside and be enveloped in a cloud of monarchs. This woman lived by the Great Lakes, and after heavy rainstorms, the ground along the lakefront would be littered with thousands and thousands of butterflies. That's how many monarchs there used to be. But in recent years, despite her efforts to help the struggling species by growing flowering plants in her garden, she now feels lucky if she is able to see five or ten monarchs a year and this is something that has filled her with a profound sense of loss. **[Slide of monarch]**
- The monarch needs your help. And in our system of participatory democracy, it will only be through your concern, your engagement, and your voice that we will be able to protect monarchs and to ensure a safer and healthier environment for both wildlife and humans. So thank you again for caring about this issue and for being here tonight.
- In addition, I'd like to thank Senator Hoylman and his staff, especially Tara Klein, for organizing this event. And a deep thank you to the senator for his leadership and foresight in sponsoring

these bills to study, halt, and ban the use of glyphosate in New York. These are a critical step in the right direction, toward ensuring that we, and future generations, will be able to continue enjoying the magnificent monarch butterfly.

III. Monarchs in Mexico

- Tonight I'll be speaking with you about phenomenon of monarch migration and about the dangerous decline that the migrating monarch population has undergone over the past two decades. However, I'll also be sharing with you a very special experience that I had working with monarchs this past year.
- Around time time of year, monarchs begin their southward migration, and for hundreds of years, it was a mystery to Americans where they went during the winter. It took about forty years of active investigation and sleuthing to solve this mystery. In the 1930s, an entomologist named Frederick Urquhart [Slide of Frederick Urquhart], who devised a system for tagging monarch butterflies, and, over the next few decades, he recruited hundreds of volunteers across the United States to tag monarchs and to find monarchs that had been tagged. When Urquhart realized that the monarchs were crossing the southern border of the United States and flying to Mexico during this winter, he sought additional volunteers in Mexico to help continue the search. It was two of these citizen scientists whom Urquhart recruited, an American named Ken Brugger, and his wife Catalina, who finally stumbled across a colony of hibernating monarchs on January 2, 1975. [Slide of National Geographic cover].
- The forests where monarchs hibernate are located high up in the Sierra Madre mountains in the Mexican states of Michoacan and Mexico. [Slide of Mexico map]. A large portion of the monarchs' overwintering habitat is encompassed within what the Mexican government has designated as the Monarch Butterfly Biosphere Reserve. The United Nations has also named the reserve as a UNSECO World Heritage Site in recognition of the natural wonder of the congregation of the overwintering monarch butterflies. [Slide re UNESCO petition]. Earlier this year, my colleagues at NRDC petitioned UNESCO to list the monarch reserve as a World Heritage "in danger" because of the butterflies' imperiled condition.
- This past winter, I had the unique opportunity to travel to the Monarch Reserve to help count monarchs in their winter habitat. Since the early 1990s, the World Wildlife Fund, in conjunction with the Mexican government, has conducted an annual population census of the overwintering monarchs. It's actually through this census that scientists are able to track changes in the monarch's population from year to year and to understand the magnitude of the butterflies' decline. Through one of my colleagues at the NRDC, I was able to get in touch with the biologists at the World Wildlife Fund who lead this effort, and they took me on as a volunteer to help with the population count and to assist in gathering data about colony health and butterfly mortality.
- Because the monarch colonies are located really high in the mountains, getting to them is not an easy task. On most mornings, the biologists and I would get up before the crack of dawn. We'd pile into these pickup trucks and drive anywhere from one to three hours to get to part way up the mountains where the monarchs were roosting. However, the roads don't go all the way up these mountains, and eventually we'd have to get out of the car and undertake a steep uphill climb of anywhere from 45 minutes to 2 hours to get to the butterflies' actual roosting locations.

- **[Slide of mountain path]** When you first start climbing up these mountains, there's really no indication that there are monarchs there. But as you climb higher and higher, you start to notice small signs of the butterflies' presence. You start to see small fragments of orange and black on the ground. And then you start to notice butterfly wings scattered all about. The closer you get, the more there are. **[Slide of monarch wings]** Eventually there comes a point where monarch wings are just strewn about everywhere, and it was like walking down a wedding aisle that had been covered with flower petals.
- I was surrounded by all these signs of monarchs, and I kept looking around and wondering to myself, "Where are the actual live butterflies?" And I distinctly remember the moment when I finally noticed them. I had been staying in a town called Zitacuaro, which was a fairly sizeable town with lots of people, traffic, congestion, and noise. So when I went up into the mountains, everything seemed so quiet and tranquil in comparison. However, as I adjusted to the surrounding serenity, I noticed that there was movement all around me. At first it was almost imperceptible, but then it became unmistakable: the entire area was palpitating with the tremors of thousands of butterfly wings. **[Slide of monarchs in the sunlight]**
- **[Slide of tree covered with monarchs]** The monarchs are a wonder to behold. On cold days, dense groups of butterflies huddle on tree trunks and hang from branches, and it's a really bizarre sight, because it looks like the trees have sprouted scales. Sometimes so many monarchs will gather on a single branch that the branch will crack and break from the weight of the butterflies.
- **[Slide of tree covered with monarchs]** The monarchs are very well-camouflaged. From far away they look like dead leaves. Although we think of monarchs as being brilliantly colored, the bright colors are only on the inside of their wings, and the outside of their wings is much duller in color, to help them blend into their surroundings and hide from predators.
- On warm days, the butterflies open their wings, and it looks like the trees are on fire. **[Slide of tree covered with monarchs]** Countless monarchs descend from their roosts in search of nectar. Butterflies fill the air, carpet the ground, and alight on flowers, leaves, and branches. Those high in the sky appear as brilliant specks of orange, like confetti fluttering in the sunshine.
- Share video. **[Video clip of flying monarchs]**

III. The Monarch Migration

- **[Slide of monarch migration pathway]** Every year, the eastern population of monarch butterflies undertakes an incredible ~2,500 mile migration
 - From Sierra Madre Mountains in Mexico, across the U.S., to southern Canada, and back
 - Takes 4-5 generations of monarchs to complete each migratory cycle
 - No monarch who arrives in Mexico has ever been there before
 - Yet, monarchs return to the same mountaintops—and indeed to the very same trees on these same mountaintops—year after year after year

- Theories behind how monarchs migrate
 - Scientists aren't sure how the monarchs do it
 - One theory: internal biological compass that functions according to the movement of the sun
 - Another theory: earth's magnetic field
 - Another theory: pheromones; smell

IV. Monarch Population Decline

- The monarch migration is a spectacular phenomenon that has evolved over thousands of years. Yet, in just a few decades, human activity has put the phenomenon in danger by causing a dramatic decline in the migrating monarch population. **[Slide of monarch decline]**
 - In 1997, over one billion monarchs journeyed from summer havens in the northern United States and southern Canada to their winter home in Mexico
 - This past year, only 56.5 million made it to their winter refuge
 - That's about six percent of the population size from 1996.
- The dwindling numbers puts the monarch population in a very precarious condition
 - Although 56.5 million sounds like a big number, to put things into perspective: In 2002, a single winter storm and subsequent freeze killed 275 million butterflies, which is more than eight times the current population size
 - So a single severe weather event of similar, or even lesser, magnitude has the potential to wipe out the entire remaining population
 - The monarch's dwindling numbers makes them extremely vulnerable to not only extremes in weather, but also to predation, disease, and other natural pressures on the population.
- There are three main causes of monarch decline, each of them driven by human activity
 - Deforestation in Mexico **[Slide of forest]**
 - These forests where monarchs overwinter are very distinctive. They consist largely of oyamel fir trees, along with some pine trees, and this mix of trees results in a particular type of forest structure and density of tree cover that create a special microclimate that is perfect for the hibernating monarch colonies. When trees are cut down, this causes gaps in the forest cover, exposing monarchs to cold temperatures and moisture that can cause them to freeze to death.
 - Thankfully, the Mexican government has responded aggressively to the deforestation problem and has significantly strengthened its efforts to enforce against illegal logging in recent years.
 - In addition, the Mexican government, in conjunction with local nonprofits and private foundations, have helped local people develop livelihoods that aren't dependent on timber
 - tourism; tour guides
 - nurseries to replant trees **[Slide of nursery]**
 - Climate change
 - Monarchs are vulnerable to extreme climate conditions, and temperatures that are either too cold or too hot can be fatal to the monarchs.

- Human activity has caused climate change to accelerate, and we've seen an increasing number of severe weather events that pose a threat to monarchs.
- Climate change can also throw off the intricate timing between the monarch migration and the growth of their food sources. That happened in 2012, for example, when unusually hot temperatures caused monarchs to migrate north before most milkweed had emerged.
- Use of herbicides **[Slide of glyphosate]**
 - However, there is strong scientific consensus that the primary cause of monarch decline in recent years has been the widespread use of herbicides—especially those containing the chemical glyphosate—which has wrought widespread destruction of the monarchs' breeding habitat in the United States.

V. Increase in Glyphosate Use; Milkweed Decline

- What is glyphosate?
 - Glyphosate is the most widely used herbicide in the United States and in the world at large. It's used in a wide variety of agricultural settings, but is also used in many non-agricultural settings, such as in parks, on residential lawns, and along highways and roadsides. Glyphosate is what's known as a "non-selective herbicide," which means that it does not discriminate between good plants and bad plants. As a result, farmers initially used only a limited quantity of glyphosate, because they were concerned that the pesticide would not only kill weeds, but would also damage and kill their crops.
 - However, in the late 1990s, Monsanto genetically engineered crops that are resistant to glyphosate. Monsanto released glyphosate-resistant soybeans in 1996, followed by glyphosate-resistant corn in 1998. These crops were quickly adopted by farmers, and by 2011, 94% of all soybean crops, and 72% of all corn crops, were glyphosate-resistant.
 - **[Slide of USDA graph]** The widespread adoption of genetically-modified, glyphosate-resistant crops has facilitated a dramatic rise in the use of glyphosate. Because farmers no longer feared that glyphosate would harm their crops, they began using a lot more of it, and the use of glyphosate has increased by over tenfold since the 1990s.
- The result has been devastating for monarch butterflies. Glyphosate kills milkweed, which is the only food source for monarch caterpillars **[Slide of caterpillar on milkweed]**
 - No milkweed = no monarchs
 - As I mentioned earlier, 4-5 generations of monarchs to complete a migratory cycle. So as monarchs are flying northward in the spring and summer, they are reproducing and laying eggs along the way.
 - When milkweed decreases, female monarchs have to expend more energy to find places to lay eggs
 - With depleted body fat, the butterflies lay fewer eggs and face a heightened risk of dying before having the chance to reproduce
 - Greater inter-larval competition over milkweed, reducing the chances that a caterpillar will survive to become a butterfly.
- The skyrocketing levels of glyphosate has decimated native milkweed populations across the United States and contributed to the loss of over 150 million acres of habitat for monarchs since 1996.

- It's no coincidence that during the same period that glyphosate use increased ten-fold, the monarch population decline by over 90%. **[Slide of monarch decline]**
- In 2014, the number of monarchs that made it to their winter refuge in Mexico was the lowest number ever recorded. The overwintering monarchs occupied a mere 1.65 acres, which is the equivalent of about one-and-a-quarter football fields.
- In the face of steep population decline and continued habitat loss, scientists have warned that the phenomenon of monarch migration is at risk of vanishing.

VI. Federal Inaction

- Despite the overwhelming scientific evidence linking glyphosate to the monarch's decline, the federal government has acted neither swiftly nor strongly enough to protect the butterflies.
 - Under the Federal Insecticide, Fungicide, and Rodenticide Act, also known as FIFRA, no pesticide may be manufactured, distributed, or used in the U.S. unless registered by the U.S. Environmental Protection Agency (EPA).
 - FIFRA prohibits EPA from registering a pesticide unless the agency determines that the pesticide can be used without causing unreasonable adverse effects on the environment.
- In addition, EPA is required to periodically review pesticides that have already been registered, to take into consideration new science and changing conditions.
 - The last time EPA completed a review of glyphosate's registration was back in 1993. This was over twenty years ago. It was before the widespread adoption of genetically-modified, glyphosate-resistant crops, and it was before the massive increase in glyphosate use and the corresponding decline in the monarchs' population.
 - **[Slide re monarchs delay case]** Last year, NRDC petitioned EPA to conduct an urgent review of glyphosate in light of the serious harm to monarch butterflies. After NRDC sued EPA this year over the agency's delay in responding to NRDC's petition, EPA announced that it would try to complete a preliminary risk assessment for glyphosate by 2015. However, the review of a pesticide is a multi-step process, and the preliminary risk assessment is . . . preliminary . . . and it might be years before EPA finalizes its analysis.
 - In the meantime, glyphosate will continue to destroy monarch breeding habitat and contribute to monarch population decline.
- To make matters worse
 - Glyphosate losing effectiveness, because weeds developing resistance
 - In response, a company called Dow AgroSciences has developed a new pesticide, called Enlist Duo. Enlist Duo is called Enlist Duo because it contains not one, but two toxic active ingredients. One is glyphosate, and the other is called 2,4-D. The idea behind Enlist Duo is that glyphosate will kill some of the weeds, and 2,4-D will kill the remaining weeds that are resistant to glyphosate. EPA first registered Enlist Duo for use in six states last year. It then expanded it to 15 states earlier this year. And now it is proposing to expand Enlist Duo to another 17 states in 2016.
 - In registering Enlist Duo, EPA failed to consider harm to monarchs, even though NRDC brought the issue to the agency's attention. EPA claimed that it didn't have to reexamine glyphosate's impacts, because it had already done so back in the 1970s and again in the early 1990s.

- **[Slide re Enlist Duo Case]** NRDC is currently suing EPA, because we believe that the law required EPA to analyze glyphosate's harmful impacts on monarchs before allowing Enlist Duo on the market.

VII. Health Risks

- **[Slide re IARC cancer categories]** In addition to posing a serious threat to monarchs, there is increasing evidence that glyphosate may also be dangerous for humans. In early 2015, the International Agency for Research on Cancer (IARC), a branch of the World Health Organization (WHO) that is considered to be the world's leading authority on cancer, classified glyphosate as a "probable human carcinogen."
 - There has been growing concern that chronic exposure to glyphosate presents a risk for the development of certain cancers. Humans can be exposed to glyphosate through various pathways, as glyphosate has been detected in the air during spraying, in water, and in food.
- In 1985, EPA actually classified glyphosate as a possible carcinogen based on experiments showing tumors in rodents that had been exposed to glyphosate. However, input from Monsanto led to a dubious reinterpretation of these studies by EPA, and led the agency to reclassify glyphosate as non-carcinogenic in 1991.
- The level of glyphosate exposure that EPA currently considers to be "safe" is 17.5 times higher than the level that EPA itself set in the 1980s, and is five times higher than the maximum level suggested by independent scientists.
- EPA has indicated that it's currently reevaluating glyphosate's risks to human health, and will consider the WHO's findings, but the agency is not obligated to make a determination until 2022.

VIII. Conclusion

- **[Monarchs Slide]** Monarchs in perilous situation
- At the same time, they're also a canary in the coal mine
- The disappearance of monarchs is a striking indicator that there are serious problems with the way in which we've become overly dependent on the use of pesticides to grow our food and to control our environment.
 - There's evidence that pollinator populations are declining across the board
 - other butterflies, bees, and other insects; it also includes bats, and birds
 - threat to food security, as about 35% of global crop production is dependent on pollination by animals
 - The excessive use of glyphosate has also degraded the quality of soil, which decreases crop productivity. Plants' roots systems rely on a complex system of bacteria, fungi and minerals in the soil. The combination, in the right balance, helps protect the crops from diseases and improves photosynthesis. Studies have shown that glyphosate interferes with mineral uptake by crops and also throws off the balance of bacteria and fungi that keeps crops healthy.
 - And, of course, there's mounting evidence that glyphosate is dangerous for people.
- In light of the federal government's glacial speed in addressing the risks posed by glyphosate, state action, such as the bills sponsored by Sen. Hoylman, are particularly critical to not only

safeguarding monarchs, but also to ensuring a sustainable food supply, a safer environment, and healthier communities.

- Seeing the monarchs this winter has been a life-changing experience. But I hope it is not a once-in-a-lifetime experience. With luck—and with effort by involved citizens and government leaders—I'm hopeful that the monarch's extraordinary migration will be around for many years to come. Thank you.