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What is causing the monarch population decline, and how can we help? This is actually a difficult question because there are a lot of different theories out there about the cause of this decline and most of our population data is fairly recent. The Monarch population is also highly variable from year to year so it can be hard to determine what is serious decline and what is normal variation. However, it is agreed that there is a general pattern of decline that is not natural, the disagreement comes over what is causing it.

Many people believe that increased use of genetically modified (GM) crops is to blame for this population decline because of their effect on plants such as milkweed. Monarchs rely on milkweed both for food and as a place to lay eggs so it is a central part of their individual and species survival. The use of GM crops has led to increased herbicide use, since these crops are immune to herbicide, but wild plants, like milkweed, are not immune so increases in herbicide use may be harming the milkweed population. However some people contest this as the reason for the monarch population decline and point to other changes in farming practices or climate change.

A 2016 study argued that there was no correlation between increases in GM crop use and monarch population decline. This 22 year citizen science study showed that population decline was not happening over the spring and summer, which are the seasons monarchs spend in the U.S. and rely on milkweed, but in the winter when monarchs migrate to Mexico. This study pointed to larger environmental changes, such as loss of winter habitat and food sources and changing weather patterns, which may affect migration, as a cause for population decline.

As often happens in science, not everyone agreed with the methods and findings of this study and in 2018 another group refuted this previous study. They argued that it was based on incomplete data and that decreased milkweed numbers due to GM crop use is, in fact, to blame for the decreased monarch population. This same 2018 study used statistical analysis of data from many different studies to show that decreased numbers of milkweed plants is correlated with fewer monarch eggs being laid and fewer monarchs surviving to adulthood, suggesting that decreases in milkweed due to the use of GM crops could be related to monarch population decline.

Last year the idea that GM crops are to blame was challenged again. These researchers used museum records to look back much further than current population data allows and found that both milkweed and monarch decline began in the 1950s, well before GM crops were introduced in 1996. This proved that GM crops are not the original cause for milkweed or monarch decline. This study pointed out that herbicides have been used long before GM crops were invented and these may have been affecting the milkweed population for a long time now. They also study pointed to other farming changes that happened in the mid 20th century, such as the consolidation of separate small farms into fewer large farms which left less barrier spaces between fields where wild plants such as milkweed could grow, as a possible cause of milkweed and therefore monarch population decline.

Between these three articles there are many different theories for the cause of monarch population decline: decreased milkweed numbers due to GM crop use or farm consolidation, wither habitat and food loss, and/or changing weather patterns. In the coming years I am sure we will see more studies either supporting one or more of these causes or suggesting new reasons.

The fact is there is probably not just one explanation for the monarch population decline. But the question is what can we do about it right now? Well, one of the easiest causes to address at the moment is the milkweed population. Two of these articles agreed that decline in milkweed number is related to decline in monarch population, whatever the cause of the milkweed decline is. I suggest we talk to farmers and encourage them to allow small borders between fields to grow wild plants. We may also try planting milkweed along roadsides and even send students home with milkweed seeds over breaks to spread the plants further, since one study found that monarchs prefer low density patches of milkweed. On top of this we can continue to encourage people to do their part to reduce climate change such as reducing consumption of unsustainable goods and composting.

#### References:

- Boyle, J. H., Dalglish, H. J., and Puzey, J. R. (2019). Monarch butterfly and milkweed declines substantially predate the use of genetically modified crops. *PNAS* 116, 8: 3006–3111.
- Inamine, H., Ellner, S. P., Springer, J. P., and Agrawal, A. A. (2016). Linking the continental migratory cycle of the monarch butterfly to understand its population decline. *Oikos* 125: 1081–1091.
- Stenoien, C., Nail, K. R., Zalucki, J. M., Parry, H., Oberhauser, K. S., and Zalucki, M. P. (2018). Monarchs in decline: a collateral landscape-level effect of modern agriculture. *Insect Science* 25: 528–541.