A Chronicle of A Resilient Species

Following the journey of a species navigating through changing environments, showcasing its adaptability and resilience

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A Chronicle of a Monarch Butterfly

It is almost time for our yearly trip down south, all the way to Central Mexico, and I am filled with anticipation and excitement. I stay close to my family as we tentatively stream out of the forest, in search of one last snack before we leave - milkweed plants. Soon enough, a massive sweeping field of green meets our eyes.

Lately, milkweed, my favourite food, tastes and smells different. My parents warn my siblings and me not to eat any more. They suspect there are chemicals called pesticides on the plants. We travel to the same areas in the U.S. which are abundant in milkweed to be fed, but this time, there seems to be much less. So much, in fact, that we have resorted to sipping bitter nectar from small flowers near the lake.

Before long, I bid a wistful goodbye to my friends. The bees and dragonflies don't migrate like I do, so they won't see me until I return. I promise them that I will be back before they know it.

The icy sea breeze glides through the cave entrance as the terrible storm outside rages. I shiver, huddling closer to my family; or rather, those who remain. We watch fearfully as massive waves scratch the smoky black sky. Many of us begin to weep, mourning the ones we lost to the storm.

Beside me, a younger butterfly whispers, "How did this happen?" Nobody knows, but my mother assumes it has to do with the world warming up.

I wonder if my friends at home are keeping well during this storm. My heart swells with worry, and I try to push those thoughts out of my mind. A cold wind rips through the entrance, and I am slammed into the cave wall. I hope we never face this sort of weather again.

After a long, treacherous flight, we make it to our destination. My wings are stiff and aching, and I'm glad to have finally arrived so I can rest. We reach the forest, and make our way to our usual spot, but once the first few rows of trees pass us, my heart drops.

It has been destroyed.

We weave through the debris, nearly snagging our wings on gnarled roots now protruding from the ground. Tree branches and bark litter the floor, but not a single tree has been left standing. All I see are fallen leaves; the last vestiges of what was our food and our home. Then a deafening sound catches my attention.

Humans.

They manoeuvre countless massive rolling blocks, crashing into trees and rolling over our milkweed. How could they do this? Some jump out, carrying long blades with rotating, sharp teeth, which make an ear-shattering sound. We watch, frozen in shock, as they cut into the fallen trees, as if they are dissecting corpses.

What is this madness? We have barely any food, and what's left is nowhere near enough. Through the shock, my mind reaches an inescapable conclusion – have humans been the reason for our suffering all this time?

We have taken residence in a fallen tree. The nights are cold, and everybody is starving. We have resorted to scavenging tiny morsels of nectar from a few desultory flowers, but it's nowhere near enough. Today, I volunteer to search for more food.

I'm only in the air for a minute when a net is thrown over me, and I am swallowed by darkness.

I wake in a glass cage within a brightly-lit room. Beyond the walls, I see humans in white coats, murmuring to each other and smiling. I look to my right, and through the window I

see a field unlike any I've seen before. It is covered with rows and rows of dark blue squares. To my infra-red vision, they almost glow red as the sun beats down on them.

My heart races as I realise that the rest of my flock is nowhere to be found. I am alone. I call out to them, but am only met with foreboding silence.

Fingers gently clamp down on me. A tiny cylinder of clear liquid is inserted into my abdomen. Suddenly, the fingers vanish. I begin to flap my wings haltingly, making sure they work.

I slowly inhale. The air here smells sour and unsettlingly familiar. With a jolt, I realise that it smells exactly like the pesticides my mother warned me about.

I turn and see the source of the smell – some strange purple flowers alongside some fresh, healthy milkweed.

My stomach grumbles. No, I tell myself. These aren't safe to eat.

Freed by the humans, I dart across the trees, brimming with excitement. I am finally ready to see my flock again! I spy some milkweed dotted amongst patches of purple flowers. They still smell sour, but this time, something inside my brain urges me that they are edible.

I give in to my hunger. I tentatively bite into the milkweed plant. I steel myself for the familiar rush of nausea and the throbbing migraine - but nothing happens.

I blink, nonplussed. I hear a distant voice behind me exclaim, "It's eating them! The gene editing might actually be working!"

My head spins. This is amazing! I devour the purple flowers and the pesticide-tainted milkweed. I could get used to this.

Many voices call out, welcoming me back home, but in my excitement, I am only focused on my flock, the ones I love the most. I have something important to tell them.

As soon as she sees me, my mother crushes me in a hug. I turn to my flock, and explain to them the superpower I now have — the pesticides and strange nectar don't make me sick anymore!

"Once the humans take you to the lab, you'll be able to do the same." I explain. How strange – we thought humans simply destroyed our homes, but they might actually be the reason we survive.

For once, I am thankful for humans. We might be able to keep migrating for many years to come!

Appendix

Scientific concepts

1: Logging and Deforestation

Deforestation is the intentional clearing of forested land for other uses such as for agriculture, urbanisation or mining, and has been greatly accelerated by human activity. Deforestation is detrimental to biodiversity, endangers ecosystems and creates natural imbalances. It also has a very strong contribution to climate change - trees absorb and store carbon dioxide throughout their lives, and destroying them will release the carbon dioxide they stored back into the atmosphere.

Fewer trees available will also mean reducing the planet's overall ability to capture and store carbon dioxide, contributing to the greenhouse affect as well as climate change.

Logging is the process of harvesting, sawing and transporting trees to make wood products. Like deforestation, logging poses a grave threat to ecosystems and climate change, mainly because of the release of carbon into the atmosphere..

2: Pesticides and their hindrance to animals

Pesticides are chemical compounds used to control various pests and disease carriers, often used in agriculture to control weeds and insect infestation. However, they also have significant unwanted effects, such as cancer, endocrine disruption, reproductive effects, neurotoxicity, kidney and liver damage, birth defects and developmental changes.

Pesticides also have the ability to alter an organism's behaviour - for example, exposure to pesticides can deprive birds of their ability to sing, attract mates and care for offspring. The US Fish and Wildlife Service estimates that around 67 million birds die from pesticide poisoning each year[1]. This has tremendously detrimental consequences for the survival of species and the biodiversity of the ecosystem.

In our story, the butterfly's flock is greatly impacted by pesticides, which limit consumption of one of their primary food sources, and have potentially life shortening effects.

[1] https://www.beyondpesticides.org/assets/media/documents/pesticidefreelawns/resources/DWDangers_Pesticides_Wildlife.pdf Defenders of Wildlife (n.d) *The Dangers of Pesticides to Wildlife* (accessed: 06-04-2024, 2:30pm)

3: The effect of climate change on extreme weather events

As fossil fuels are burned, carbon dioxide is released into the atmosphere. As carbon dioxide traps solar radiation, it causes the temperature on the Earth's surface to rise. This fuels extreme weather events like hurricanes, which are growing more powerful and frequent because they draw energy from warm ocean water. The warmer air increases evaporation, which magnifies the amount of precipitation, leading to heavier rainfall and more frequent flash flooding.

Warming of the ocean has resulted in catastrophic declines in polar ice, which feeds a vicious cycle leading to dramatic increases in water levels in places distant from the poles, and provides even more water for precipitation, magnifying the extreme weather events mentioned. A study on extreme weather attribution suggests that 71% of extreme weather trends and events were made more likely or more severe by human-caused climate change.[2]

4: Climate change adaptation in animals – genetic engineering

Our story describes how genetic engineering of butterflies could help them become both more adaptable to climate change and more resistant to pesticide use.

Scientists are currently working to address the issues of climate change by using gene editing technology in animals, one of which being CRISPR. There have been multiple cases, such as that of coral, fish or livestock, whose use of CRISPR or other gene-altering techniques has helped them adapt to climate change - whether it be adapting to higher temperatures, disease resistance or metabolic alterations to keep pace with the rapidly changing climate. For example, cattle living in tropical regions have adapted to rising temperatures by expressing a gene named Slick, which gives them shorter hair and improves their heat tolerance. Scientists are working on using gene editing technology to deliberately express this gene in larger numbers of cattle, which should increase their overall rate of adaptation.

5. Climate change mitigation through renewable energy source deployment

In our story, solar panels are mentioned as the energy generators for the lab the butterfly is trapped in. Solar panels harness energy from the sun, or solar energy, and convert it into electricity. Alternatively, they can be used to heat air, water or other substances. In 2020, more than 30% of Australian households had rooftop solar panels.[3]

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[2] https://www.carbonbrief.org/mapped-how-climate-change-affects-extreme-weather-around-the-world/ Carbon Brief (2022) *Mapped: How climate change affects extreme weather around the world* (accessed 06-04-2024, 9:15am)

[3] https://arena.gov.au/renewable-energy/solar/ Australian Renewable Energy Agency (2024) *Solar Energy* (accessed: 09-04-2024, 10:36am)

Solar electricity produces zero direct greenhouse gas emissions as the energy is made from sunlight rather than burning fossil fuels, which are finite and major contributors to climate change.

Using alternative sources of energy that are less harmful is just one of the ways humans have been working to address and eliminate the ongoing climate crisis.

Bibliography

https://arena.gov.au/renewable-energy/solar/ Australian Renewable Energy Agency (2024) *Solar Energy* (accessed: 09-04-2024, 10:36am)

https://www.carbonbrief.org/mapped-how-climate-change-affects-extreme-weather-around-the-world/ Carbon Brief (2022) *Mapped: How climate change affects extreme weather around the world* (accessed 06-04-2024, 9:15am)

https://www.beyondpesticides.org/assets/media/documents/pesticidefreelawns/resources/DWDangers_Pesticides_Wildlife.pdf Defenders of Wildlife (n.d) *The Dangers of Pesticides to Wildlife* (accessed: 06-04-2024, 2:30pm)

https://earthjustice.org/feature/how-climate-change-is-fueling-extreme-weather Earth Justice (2023) *How Climate Change Is Fueling Extreme Weather* (accessed: 06-04-2024, 9:25am)

https://allianceforscience.org/blog/2020/01/5-ways-crispr-engineered-animals-can-help-combat-climate-change/ Gallegos, Jenna (2020) 5 ways CRISPR-engineered animals can help combat climate change (accessed: 8-04-2024, 11:20am)

https://licnz.com.au/news/slick-developing-heat-tolerant-dairy-animals/ Livestock Improvement (2023) SLICK: developing heat tolerant dairy animals (accessed: 11-04-2024, 10:45am)

https://www.epa.gov/safepestcontrol/why-we-use-pesticides *United States Environmental Protection Agency (2023) Why We Use Pesticides (accessed: 04-04-2024, 3:10pm)*

https://www.worldwildlife.org/species/monarch-butterfly World Wildlife Fund (2024) – Monarch Butterfly (accessed: 26-03-2024, 3:00pm)

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