

## **Thinking Bee: The Impacts of Pollinators on Rangelands**

### **Introduction:**

When people consider solving the problems on our rangelands, some try to think big. But what most people don't realize is that, in order to think BIG, we have to think small. This is where pollinators fit in. These tiny creatures can be the difference between a healthy and thriving range, and one that can't be salvaged. Unfortunately, due to the increase in habitat conversion and insecticide use, these creatures are being threatened, and if we don't act quickly, our rangelands will suffer the consequences. In order to understand the implications of mass pollinator die-outs, we first need to understand what pollinators are and what they contribute to rangelands, as well as the anthropogenic causes of these die-outs. We must also consider the possible solutions to these problems, as thinking about the small creatures in our rangelands is the first step to solving the big issues concerning soil health and lack of species diversity in these areas.

### **What Pollinators Contribute to Rangelands:**

Pollinators are a diverse group of animal and insect species that transfer pollen from one plant to another, a service that is necessary for the reproduction of plants throughout ecosystems. The most abundant pollinators in California are bees, butterflies, moths, and birds. According to the Xerces Society, roughly "85% of terrestrial plant species either require, or strongly benefit from, animal-assisted pollination"(Xerces website). Some plant species need certain pollinators, while others can be pollinated by a variety of species. Therefore, the existence of a variety of pollinators in rangelands enriches the biodiversity of rangelands in a multitude of ways, in particular the viability of the soil, and is necessary for the health and survivability of these areas. Though in rangelands grasses don't require animal pollination, as they are wind-pollinated, forbs

and shrubs, which are abundant and essential to the range ecosystem, rely heavily on these services.

Increasing forbs (most commonly clover, trefoil, and wildflowers) and shrub species throughout rangelands provide necessary forage for wildlife. This forage attracts species such as game birds and provides a habitat for many native species in the area. Furthermore, pollinators ensure the survival of many rare and at-risk plant species throughout the country. Having a variety of plant and animal species on the range can decrease the risk of overgrazing by a single species, such as cattle. Additionally, having this biodiversity among plants makes the soil more resilient, thus decreasing the risk of soil erosion during times of drought. In addition to the biodiversity among plant species in rangelands, pollinators themselves contribute to the wide array of insect species in these areas, as well. In California, there are roughly 1600 native bee species. Among these, 120 of the 958 identified species have been found to be endemic to California. Moreover, “nearly 800 species of butterflies and 11,000 species of moths are found in North America alone” (McKnight et al, 2018). Such a wide variety of bee and butterfly species provides species richness throughout California rangelands, which increases the durability of these areas. However, there are many aspects of human activity that have led to a decrease in diversity among these species.

### **Anthropogenic Causes of Pollinator Die-Outs:**

Pollinators need 3 things for survival. These include food in the form of pollen, nectar, and host plants, a place to build their nests, and a pesticide-free environment. Unfortunately, in recent years, each of these necessary aspects of survival has been damaged in one way or another. Many of the causes of these die-outs are anthropogenic, with the use of pesticides, as well as habitat conversion, being at the top of the list. One of the most talked about pesticide

groups in terms of damaging pollinator species is neonicotinoids. Neonicotinoids are a group of pesticides that treat seeds of flowering plants in order to make them resistant to pests. These pesticides are mainly used on agricultural areas, yet they can be leached into the soil and impact pollinators in other areas. These chemicals don't have a strong impact on mammals. However, they often cause overstimulation in the bee's central nervous system, which can decrease taste sensitivity, as well as flight and navigation, among these species. Though there has been an increase in regulations of neonicotinoids in recent years, not all pesticides have been banned. Additionally, these pesticides are water-soluble, which means that they remain in the soil for months or years after they were originally introduced: neonicotinoid "residues have been found in woody plants up to six years after soil drench application"(Code et al, 2016). Contamination in the soils has caused huge swaths of bee populations, as well as the populations of other pollinators, to decrease, which has grave implications for soil strength on rangelands.

In addition to having a pesticide-free environment, pollinators must have an area for habitat. Many native bee species are ground-nesting, with the ratio between ground and stem-nesting species being about "70:30"(Kangas, 2022). With such large populations of bees needing loose and open soil areas for nesting, habitat fragmentation and conversion become large-scale problems. Climate change, agricultural needs, and commercial development have all contributed to habitat loss for pollinators, with commercial development being at the forefront. A study conducted by the Nature Conservancy found that, "between 1984 and 2008...over 195,000 hectares[about 482,000 acres] of rangeland habitats were converted", with the "majority of conversions [being] residential and associated commercial development (49% of the area converted)"(Cameron et al, 2014). That amount of land is over 7 times the area of Sacramento, and over 12 times the area of my hometown of Stockton. Additionally, human-caused climate

issues are hindering progress for pollinators, as well. Changes in weather patterns can cause flowers to bloom at later times, hampering a pollinator's ability to forage, and thus weakening the population. Agricultural efforts on rangelands that convert the land to croplands take away many of the native attractors of pollinators, which also diminishes their ability to forage. Among ranching areas, "overgrazing, as well as a lack of grazing by cattle", can also impair pollinators' ability to find shelter and forage (Moranz, 2022).

Though it is difficult to track the true number of species that are threatened by anthropogenic activity, the "Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) estimates that 40% of invertebrate pollinator species may be at risk of extinction worldwide" (McKnight et al, 2018). In North America alone, about 19% of the butterfly species and 27% of bumble bee species have been listed as being at risk or endangered. These numbers, though not specific to California, show that there are great numbers of species under threat, which increases the likelihood that rangelands will suffer exponentially.

### **Solutions:**

To combat these mass die-outs of pollinators, major action steps must be taken throughout rangelands. Planting native forbs and shrubs, monitoring the grazing of livestock in the area, and minimizing pesticide use in these areas will be critical moves to reverse the anthropogenic damage among pollinator species. Planting native plants in range areas will restore many of the natural food sources for pollinators and may provide ground cover and nesting opportunities for others. In order to ensure a wide variety of pollinator species, it is imperative to include a diverse group of native plants. These should be a mixture of annual and perennial species and include both forbs and shrub species. In California, such assortments could include milkweed, California lilac, California fuchsia, asters, lupine, and trefoil. Narrowleaf

milkweed is the most common milkweed species in California and is a vital food source for monarch butterflies. Other, more general, plant species that attract a wider variety of pollinators include lilac, fuchsia, aster, and lupine, which are all highly drought tolerant, making it more likely that they will flower and provide forage for pollinators, even during dry seasons. Though many of the native species that are most beneficial to pollinators are toxic for livestock, these plants are avoided by them. On the other hand, annual and perennial grasses, though not reliant on animal pollination, can provide a habitat for pollinators in addition to forage for livestock. However, these grasses can be at risk from overgrazing if range management is not maintained. Monitoring the grazing patterns of livestock and encouraging rotational grazing would minimize the problems associated with such activities.

Along with planting native plants and monitoring grazing patterns, ensuring that the range areas are free of harmful pesticides is another important step in restoring pollinator habitat and reversing the impacts of human activity. Neonicotinoids, though banned in the European Union, are still used throughout the United States, remaining the most popular insecticides in the country, most commonly used in the agricultural industry on croplands. The Environmental Protection Agency has reviewed the chemicals involved, but the efforts to ban these products will not be complete until 2024. In the meantime, alternative solutions must be practiced to reduce further damage. Alternatives to such insecticides include integrated pest management, which can incorporate a mixture of trapping methods and targeted spraying with less harmful chemicals during times outside of the blooming season. Taking these simple, yet necessary steps to restore habitat for pollinators will, over time, greatly reduce the anthropogenic damage done to rangelands.

**Conclusion:**

In looking at the impacts of pollinators in rangelands, it is clear that all species, even those that are often overlooked, play a significant role in the survival of an ecosystem. The act of pollination by animal and insect species is necessary and beneficial for about 85% of all plants. Even for plants that don't require animal pollination, such as grasses, the very existence of these creatures increases biodiversity within an ecosystem, thus ensuring a stronger and more durable environment. However, recent anthropogenic causes, including habitat conversion and pesticide use, have greatly harmed these pollinator species, which also has grave impacts on rangelands. Incorporating simple actions such as planting native, drought-tolerant plants, monitoring grazing patterns of livestock, and taking part in integrated pest management practices will aid in the restoration of pollinator habitat. Habitat restoration will encourage the recovery of pollinator species which will, in turn, be an important step in addressing areas in rangelands that are facing soil erosion and low species richness. This is why, in order to think big when considering solutions to rangeland problems, we have to think small.

## References

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