

# Interacting effects of disease and weather variability on rangeland biodiversity associated with black-tailed prairie dog (*Cynomys ludovicianus*) colonies

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**Burrowing rodents** occupy rangelands worldwide and provide ecosystem services for associated wildlife, but simultaneously conflict with livestock production because of forage competition.

In the North American Great Plains, populations of black-tailed prairie dogs have historically been controlled to minimize conflict with livestock and have been further reduced because of outbreaks of disease (sylvatic plague, *Yersinia pestis*).

We capitalized on a natural experiment to evaluate vegetation structure and avian communities before (2015–2017) and after (2018–2019) a major sylvatic plague outbreak in prairie dog colonies in northeastern Wyoming, USA.

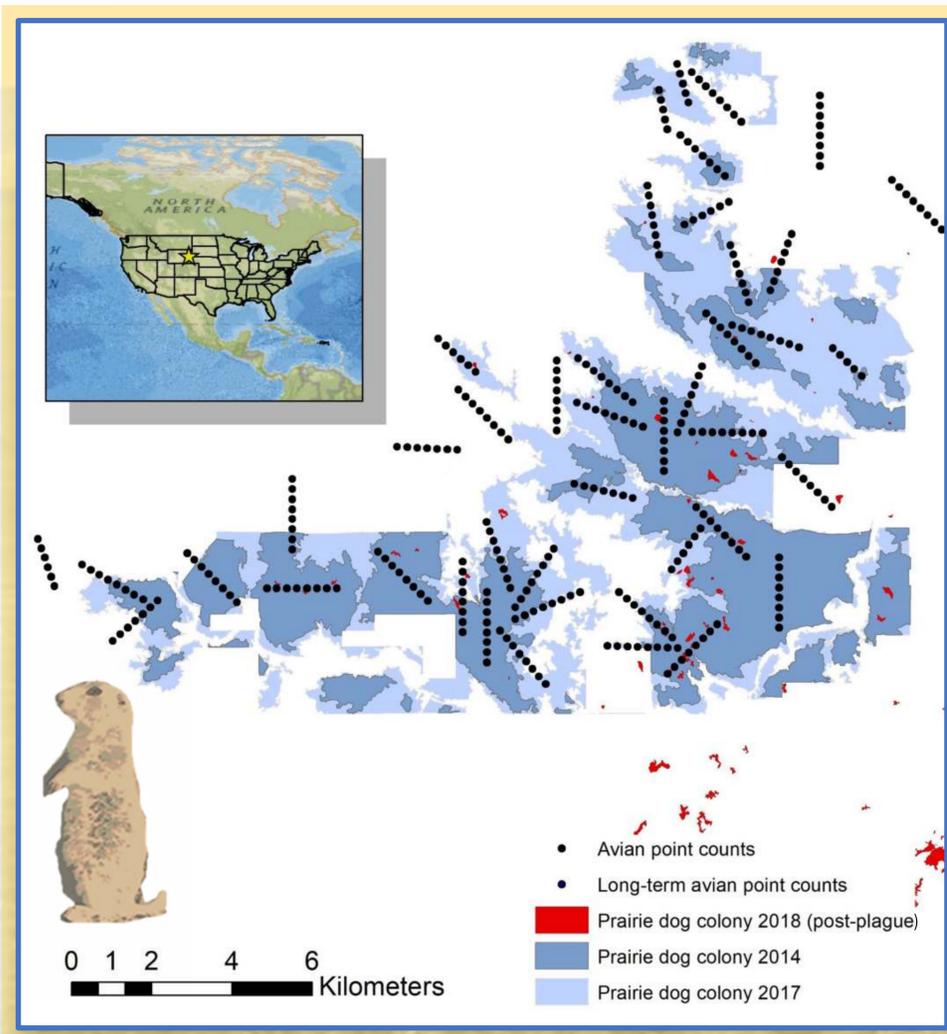


Figure 1. We conducted work entirely on public lands in the Thunder Basin National Grassland, USA. Our study was initially established to monitor songbirds, shorebirds, and raptors on prairie dog colonies, transition zones, and areas without prairie dogs. Colonies expanded drastically from 2015–2017, exceeding 16,000 hectares before sylvatic plague led to a 110-fold reduction in colony cover in 2018. All point count locations were visited between mid-May and early July corresponding to the breeding season in this region. We also collected data on visual obstruction and vegetation height at each site using a Robel pole (Robel 1970).

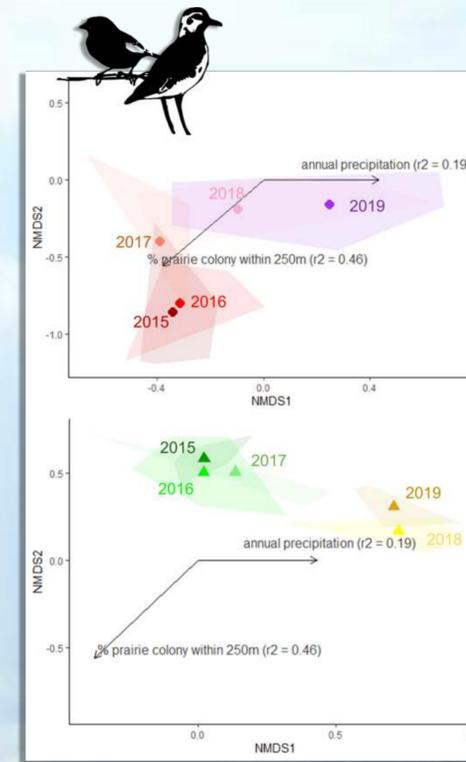


Figure 2 (ordinations). Change in bird communities associated with prairie dog colonies (top panel) and off colonies (bottom panel) across five years in response to precipitation and disease in NE Wyoming, USA. Vector overlays indicate direction of greatest change in percent prairie dog colony cover and annual precipitation. Bird communities on prairie dog colonies shifted following the plague outbreak in late 2017, which was a function of reduced mountain plover and horned lark numbers and increased abundance of lark buntings and grasshopper sparrows



Figure 3. Abundance of raptors across 5 years in NE Wyoming. Scientific names for species: Ferruginous Hawk (*Buteo regalis*), Golden eagle (*Aquila chrysaetos*), Northern harrier (*Circus hudsonius*), American kestrel (*Falco sparverius*), Red-tailed hawk (*Buteo jamaicensis*). Shaded area denotes post-plague.

## Vegetation changed rapidly following plague

- Visual obstruction on colonies ( $2.5\text{cm} \pm \text{CI } 0.25$ ) was 1/3 of that off-colonies from 2015–2017
- By 2019 (2 years post plague), visual obstruction was  $>6\text{ cm}$  on-colonies
- Vegetation structure also increased by 1–2 cm in previously uncolonized areas due to extreme precipitation in 2018

## Avian community structure shifts were driven by loss of prairie dogs and increased precipitation

- Mountain plovers (*Charadrius montanus*), which breed almost exclusively on prairie dog colonies in this landscape declined drastically following plague
- Ferruginous Hawks and Golden Eagles, two species that utilize prairie dogs as a large proportion of their diet, also declined
- More nomadic mixed-grass obligates like Lark Buntings (*Camalospiza melanocorys*) were 4x more abundant in 2018 and were observed in high numbers across the study area.

## Takeaways:

**Interactive effects of disease and climatic variation can lead to extremely rapid shifts in wildlife communities.**

**Grassland fauna are adapted to spatiotemporal variability in habitat, but novel climate and disease regimes warrant increased awareness of the threats these species face**

## Acknowledgments

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