Analysis of a Blackbird Roost Using Weather Surveillance Radar

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Background

- Weather Surveillance Radar (WSR) is increasingly used to monitor biological phenomena.
- WSR has been used to study many airborne animals including bats, insects, and birds [1-4].
- Blackbirds often fly below elevations scanned by WSR (less than ~500m above ground level). However, near Bismarck, ND, blackbirds roost within 20km of the NEXRAD (KBIS) site. At this distance, it is likely that WSRs detect blackbirds leaving roosts on at least some occasions.
- One roost was routinely detected by KBIS during morning exodus of blackbirds. (Figure 1) Some of those observations coincided with field observations of blackbirds departing the roost. Other roosts in the area were not detected on radar.
- Monitoring of blackbirds using WSRs in North Dakota is limited to cases where roost are located very near to the WSRs. At greater distances from the radar blackbirds will literally be flying under the radar.

Bismarck Weather Surveillance Radar. Photograph by Bismarck Tribune, 2018

Methods – Field Observations

- Our initial step was to collect field observations of blackbird abundance at a roost near Bismarck, ND.
- We routinely estimated the blackbird population during roost morning exodus near sunrise from mid-September to late October in 2019. (Figure 2)
- We will compare these field estimates of abundance with radar-based estimates.

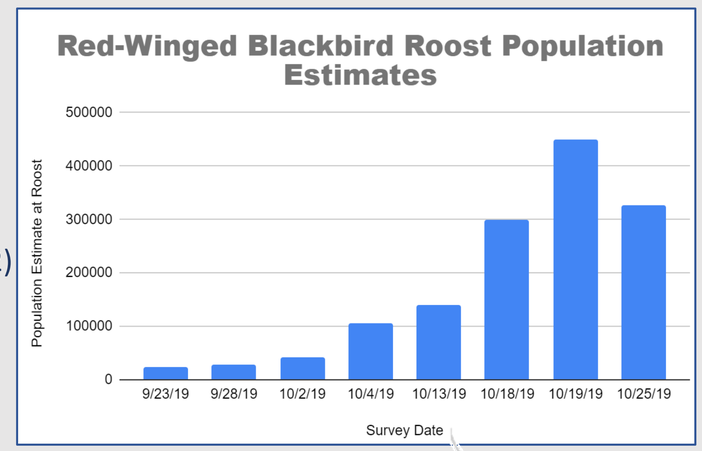
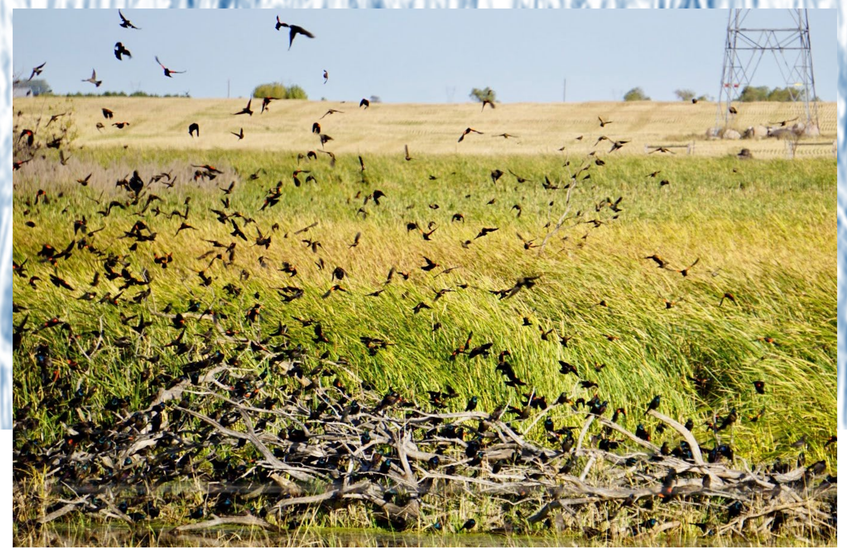


Figure 2: Field estimates of blackbird abundance at the roost near Bismarck, ND.

Methods – Radar Analysis

- We will estimate the number of blackbirds in a radar elevation sample using an approximate radar cross section for a single red-winged blackbird.
- We will calculate the daily maximum number of blackbirds detected by radar and compare that with field recorded observations on abundance.



Red-winged blackbird flock in cattails. Photograph by Alli Schumacher, 2019.

Radar Reflectivity (dBZ)

- WSRs samples atmospheric data every 10 minutes or less in 360-degree sweeps at set elevation angles. [5]
- Each sweep of the radar produces data on the amount of returned signal (radar reflectivity).
  Reflectivity can be precipitation, birds, insects, bats, etc.[2].
- Reflectivity values as great as 30-35 dBZ can result from birds in flight, usually migration or departing from a roosting site [6].
- We can usually distinguish precipitation from biological reflectivity using radar data alone, but the identity of the biological masses in flight would remain uncertain without ground-truthing. Our field study has identified red-winged blackbirds (*Agelaius phoeniceus*) as the main species of this roost emergence on radar.
- Reflectivity data are continuously archived from 1991 to the present at NOAA's National Center for Environmental Information (NCEI) and are made available to the public via Amazon Web Services and other platforms. These data can also be accessed through the NWS Weather and Climate Toolkit program [5].

Summary

- This study seeks to validate a method for monitoring blackbird abundance at roosts.
- At the few roosts located very near to WSRs, radar-based abundance estimates of blackbirds could provide new insights to trends in abundance that might improve blackbird management.

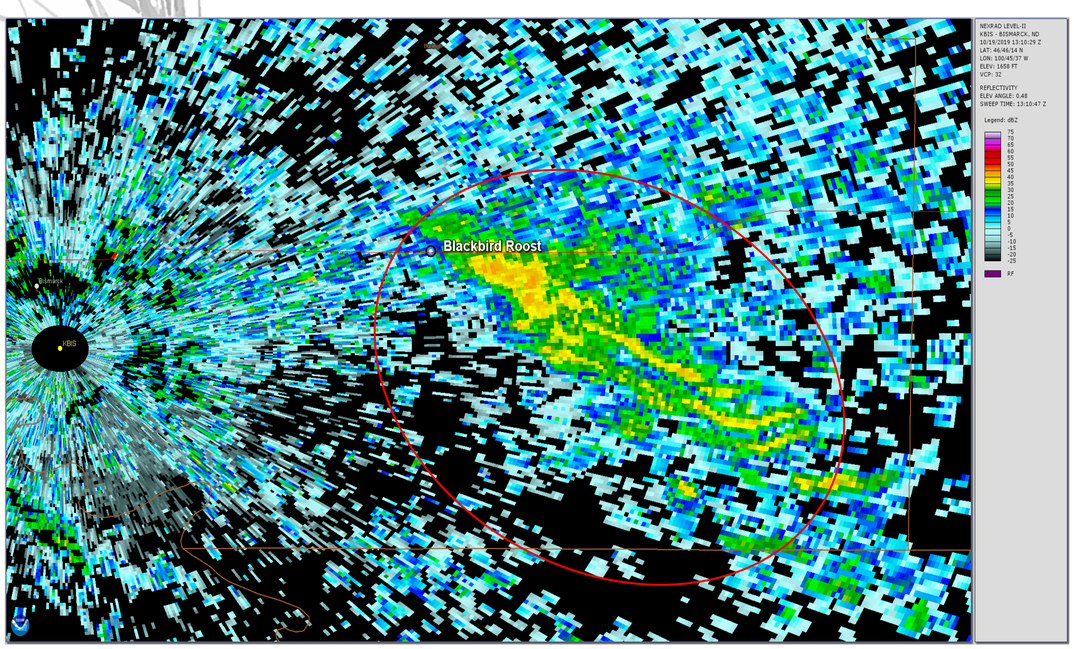


Figure 1: Blackbird flock emergence from roost at sunrise UTC on 10/19/2019 displayed on weather surveillance radar using the Weather and Climate Toolkit (WCT) software available from NOAA. Reflectivity of 30-35 dBZ represented in yellow are blackbirds.

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