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Letter to the Editor

Land cover dynamics across the Great Plains and their influence on breeding birds: Potential artefact of data and analysis limitations

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1. Introduction

The distribution and abundance of obligate grassland breeding birds in the US have declined across the Great Plains as native habitats have been converted to intensive human land use. A major finding of Scholtz et al. (2017: Table 3) was that the group-wise extinction rate among 13 common grassland nesting birds declined with increasing cropland. This conclusion runs counter to expectations and may be attributable to an artefact of flawed data or analyses. Here, we outline four concerns that may be contributing to the counter-intuitive association.

2. Scale incongruity between landscape characterization and bird response

Scholtz et al. (2017) characterized landscape composition using a circular (1.6-km radius) buffer centered on start locations of Breeding Bird Survey (BBS) routes. Furthermore, the authors resampled the native resolution of the land cover data (3136-m^2 for 2006–2009; 900-m^2 for 2010–2015) to a coarser 3-km^2 raster leading to a 'loss' of rarer land cover types. Proportions of eight land cover types within the start location buffer were used as covariates to explain route-wide bird occupancy patterns. This approach would be defensible if land cover composition within the route's start location buffer, using the coarser raster, was representative of the land cover composition along the entire length of the BBS route, using the native resolution of the land cover data. We tested this assumption with 2015 CropScape data by pairing landscape composition (proportions) vectors for the start location buffer with the route length buffer and taking the absolute difference $|D_i|$ for each land cover type i as a measure of absolute bias. If the start location land composition vector was representative of the entire route, we would expect the bias ($|D_i|$) ≈ 0. Start location buffers observed, on average, 4.2 fewer land cover types than route path buffers (range = 1–6). The percentage of routes that exceeded an absolute bias of 0.25 was 38% for cropland and 40% for grassland (Appendix: Fig. A1). Thus, models fit with route-wide bird observations will be poorly predicted by unnecessarily coarse landscape composition covariates measured over a small and unrepresentative portion of the entire route path.

3. Land cover data inaccuracies over time

Reitsma et al. (2016: 267) evaluated CropScape data across South Dakota and found that accuracy depended both on year and dominant land cover type. The "year effect" is reflected in Figs. A4 and A5 of Scholtz et al. (2017: Appendix), where cropland and grassland proportions across their study area show unrealistic dynamics. Cropland increased by > 16% in a single year (2007–2008), whereas grassland declined by 15% over the same time period, only to recover that net area loss by 2009. Reitsma et al. (2016: 271) strongly cautioned about using CropScape to examine land cover dynamics, concluding "…that accuracy differences between years complicates the use of [CropScape] to estimate land-use changes…"

4. Design uncertainty in fitting multi-year dynamic occupancy models

To the authors' credit, they attempted to account for imperfect detection in fitting multi-year dynamic occupancy models. However, it is unclear what constituted the secondary sample over which population closure is assumed for detection probability (p) estimation under the robust design (Pollock, 1982). The primary sample, over which the occupancy state can change, was apparently the route-year. According to Scholtz et al. (2017: 326), the secondary sample "…was the single survey on each route in each year." But, that description leaves it unclear as to what was used as the set of repeated/replicate searches such that detection failures among a subset of secondary samples informed the estimation of p. We suspect that they substituted spatial subunits for temporal replicates. Such a space-for-time substitution would assume that each species is available for detection across all spatially arrayed secondary samples associated with an occupied route (Kendall and White, 2009). If, however, a species is truly absent from one or more of the secondary samples when the primary sample is considered occupied, then detection probability will be biased downward

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and occupancy will be biased upward. Strong patterns of land cover heterogeneity along the route would likely result in true absences (Appendix: Fig. A2) being treated as detection failures.

5. Observer effects were ignored

The authors claim they did not have access to observer identities (Scholtz et al., 2017: 326); yet all users of the BBS can access observer codes in the *weather.zip* file (available online: ftp://ftpext.usgs.gov/pub/er/md/laurel/BBS/DataFiles/). There was an average of 1.73 unique observers for each of the 270 routes[1] over the 2006–2015 period (range = 1–6 observers). Past investigations have demonstrated start-up effects with first-year observers being less efficient at detecting species (Kendall et al., 1996), and an optimistic bias given a general pattern of more-skilled observers replacing less-skilled observers over time (Sauer et al., 1994).

These are not new issues to Scholtz et al.; all were raised during manuscript review. However, the import of the limitations linked to these issues was not appreciated equally among those that considered this manuscript. In submitting this letter our hope is to minimize the chance for misinterpretation and to motivate others to reexamine the consequential questions posed by Scholtz et al. (2017) using data and methods unaffected by the concerns outline here.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.biocon.2017.07.002.

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[1] The authors claim that they used 180 routes in their analysis (p. 324). However, they display 270 routes across the Great Plains (Scholtz et al. [2017: Fig. 1]). We were able to replicate the 270 routes based on their stated selection criterion. What remains unstated in the paper are the criteria used to reduce the route sample by 1/3.

Appendix:

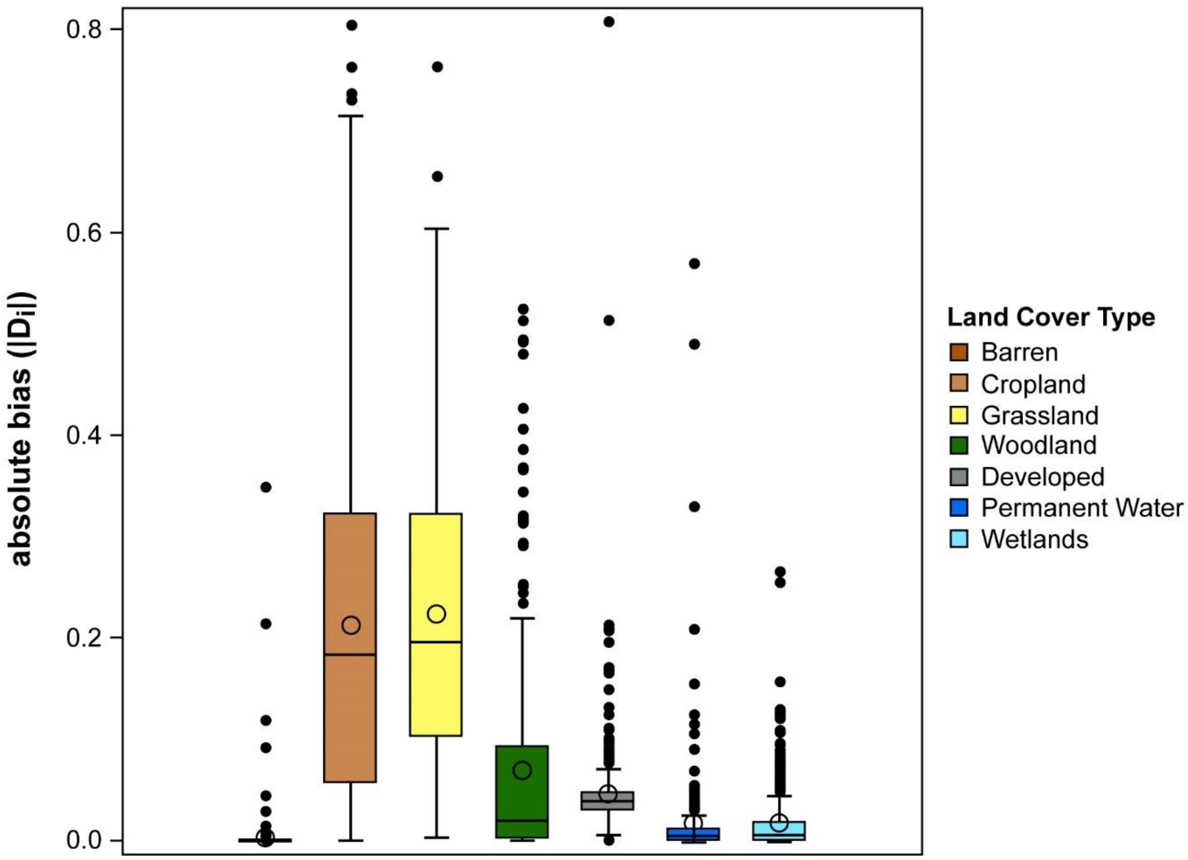

Figure A1. Absolute bias ($|D_i|$), measured as the absolute difference in land cover proportions between start location buffers (1.6 km radius circle overlain at the route start location) and route path buffers (1.6 km buffer along the entire route path). The colored box defines the interquartile range; the open circle is the mean, the horizontal line is the median, the whiskers are defined by the observation that is ≤ 1.5x the interquartile range unless bounded by 0, and the solid circles represent outliers (i.e., observations > 1.5x the interquartile range).

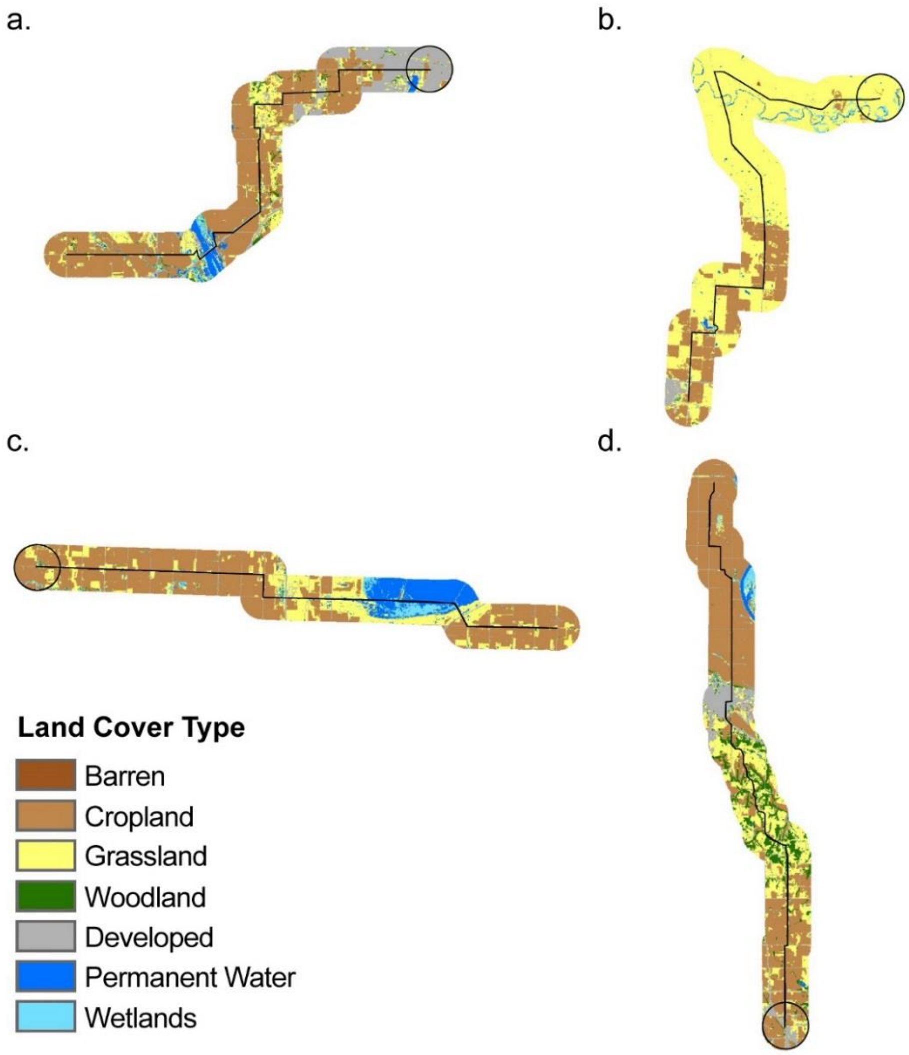

Figure A2. Land cover types along BBS routes in the Great Plains using 2015, 900-m^2 raster data from CropScape. The 1.6 km radius circular buffer used by Scholtz et al. (2017) is shown at the route's start location. Each panel shows a different example of where true absences may occur among spatially arrayed secondary samples used to estimate detection probability: a) developed land dominates the beginning route segment (54012) where grassland nesting birds may be truly absent; b) a route (81038) that is first dominated by grassland and then transitions to grassland/cropland mosaic where bird species composition might be expected to vary among the two route-halves; c) wetland associated birds may only be expected to occur along the latter segments of this route (38020); and d) heterogeneous middle segments (54013) may be the only segments where woodland-associated species occur. Parenthetic numeric codes identify the BBS route; first two digits reference the state (38=Kansas; 54= Nebraska; 81= South Dakota) and the last three digits reference the route.