

Supplemental Materials 1

HABITAT ASSOCIATIONS OF GOLDEN EAGLE PREY INFERRED FROM PREY

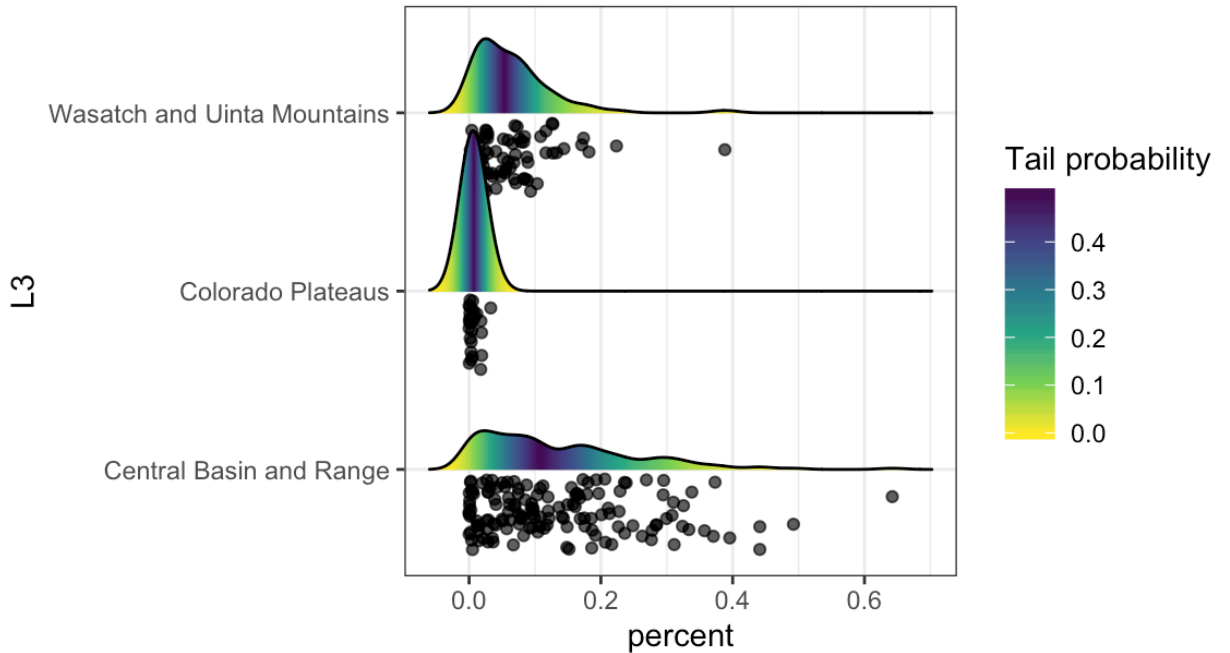
REMAINS AT NESTING SITES IN UTAH, USA

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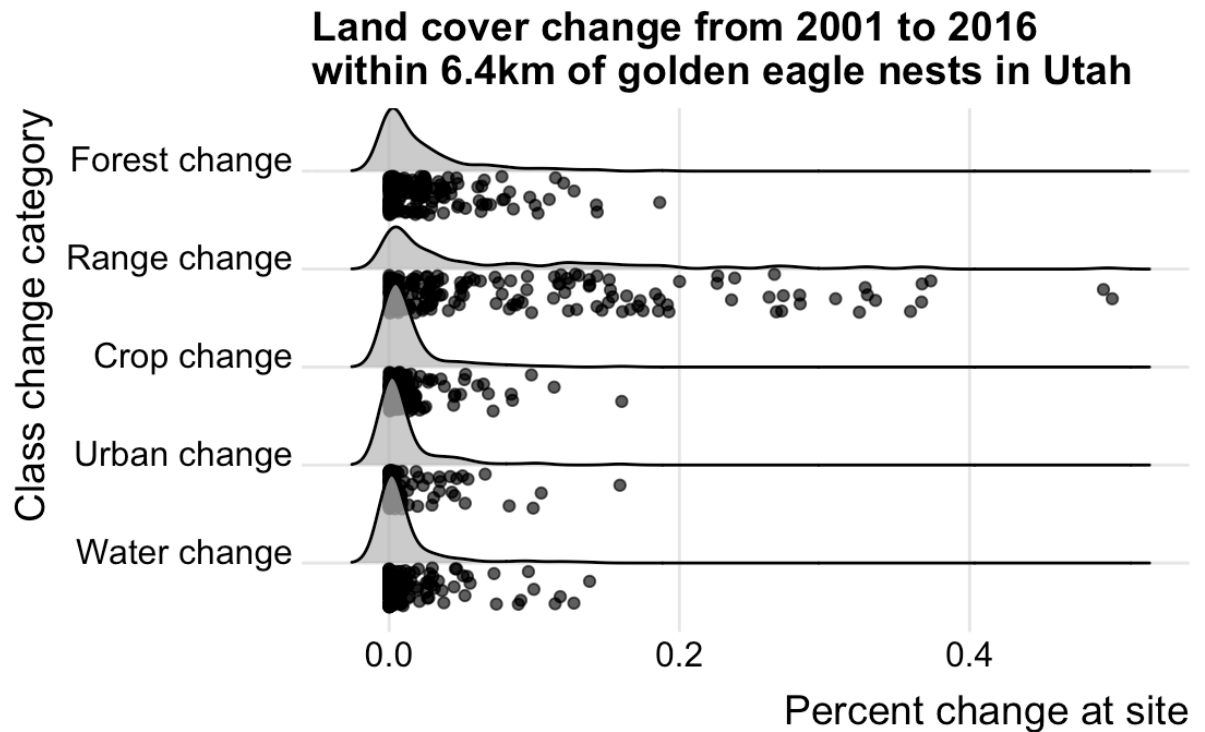
Investigation into land cover change at Golden Eagle nesting sites in Utah. Ideally, we would leverage our long-term dataset to its fullest extent by examining patterns of prey over time with estimates of land cover specific to the year of sampling. However, doing so would not be trivial because robust land cover maps are NOT available for the entire study's duration. The NLCD layers date from 1992 at the earliest, and are not annual products until 2016. We have found “reconstructed” land cover products (the historical LULC models from 1938-1992), but these are at coarser resolution (250 m) with different classes than the NLCD taxonomy, and are known to be less robust. Our more specialized layers of pinyon pine (*Pinus spp.*) and sagebrush (*Artemisia spp.*) cover are certainly not available for the earlier nesting attempts.

We nevertheless attempted to assess how much a problem relatively recent land cover change could be for our sample of nesting sites. We examined the land cover change within our buffered nesting sites using the NLCD 2001-2016 land cover change map product (description at <https://doi.org/10.1016/j.isprsjprs.2020.02.019> and data available for download from download tab at <https://www.mrlc.gov/data/nlcd-land-cover-change-index-conus>). Most nesting sites showed very little change, as measured by the number of pixels changed over time. We found that 39 of the 254 nesting sites, or 15%, showed at least 20% of their pixels as having changed during that time period. The nesting sites with the most changes seemed to be in the Central Basin and Range ecoregion (see below).

Land cover change from 2001 to 2016 within 6.4km of golden eagle nests in Utah



All land cover changes are likely not equal for wildlife. One could envision that changes to, for example, urban cover class might be more consequential than a change among natural land cover classes. The majority of the changes observed near Golden Eagle nesting sites involved the pixel class “Persistent Grassland and Shrubland change.” According to the metadata, “this change index attempts to identify changes to persistent Grassland and Shrubland areas, and to separate them from transitional shrubland areas such as regenerating forests.” The next most common types of changes included forest, water, crop type, and urban cover changes (see below).



Although quite interesting, the more relevant matter is whether those nesting sites where there was notable land cover change showed wildly different patterns in prey. We have not fully repeated the analyses, but a quick assessment of the mean number of prey items for the top four species did not seem to differ (for the 39 “changed” sites, mean of prey pooled over all years, jackrabbits = 55.7, cottontails = 9.6, rock squirrels = 4.6, and marmots = 3.1; for the whole set, jackrabbits = 63.6, cottontails = 9.4, rock squirrels = 7.0, and marmots = 4.7). Since so many of the nesting sites with larger amounts of change were in the Central Basin and Range, we would expect slightly different numbers of the more montane/agriculture prey items, but it is encouraging to see how closely the leporid counts match.

Thus, we contend that the information that we have does not suggest that the observed patterns are strongly influenced by land cover change at the scale that we investigated. Quite possibly, the eagle nesting sites tend to be in locations distant from the centers of urbanization and agricultural intensification in Utah, and/or that our buffer size does not pick up the somewhat nearby changes. Since invasive annual grasses such as cheatgrass (*Bromus tectorum*) are simply lumped into the Grassland land cover category, their invasion might not be well reflected by changes in NLCD land cover.