Point Count Manuscript Outline

Goal: To use bird data to evaluate the outcomes of over ten years of restoration treatments in adjacent low-elevation plant communities on the MPG Ranch. These plant communities include:

* Floodplain forest
* Low-elevation grasslands
* Shrubby Draws
* Mid-elevation sagebrush??

The main message of the paper would be that restoration works, but takes a long time show benefits. Monitoring for 5 years would not have showed a response or would have shown even a decline for many species.

What makes our datasets unique?

We have over ten years of continuous bird data, collected mostly by the same observers. We can look at effects on bird species and communities both across the landscape and within individual plant communities. Most work of this kind would focus on a single plant community. We know by our observations that birds move between these communities, and the juxtaposition of these communities likely results in greater benefits than any one plant community alone.

**Methods**

**BIRDS**

**Point Counts**

Our surveys encompassed 196 points though survey effort varied in some years. Points were spaced approximately 250 m apart on a grid that began with a randomly generated initial point. Points encompassed all available plant communities within our low- and mid-elevation restoration areas and in some cases more than one plant community occurred in proximity to a given point. Available plant communities at some points changed over time as restoration activities changed the landscape.

A picture containing several

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We conducted point counts from 15 May to 15 July in all years. Point counts began 15 minutes after sunrise and were completed approximately 4 hours later, somewhere between 10:00 and 11:00 Mountain Standard Time. We considered field conditions unacceptable for surveys if weather influenced bird activity (e.g. continuous rain, high winds, extreme heat) or we experienced conditions that limited visual or aural detections (e.g., wind, fog, anthropogenic noise). At each point, we noted survey conditions including date, first or second visit, time survey began and ended, Beaufort wind-scale code, amount of cloud cover, temperature, and any persistent non-avian noise.

We surveyed birds for 10 minutes divided into two intervals of five minutes. For each detection, we noted species, abundance, sex, identification method (e.g., song, call, visual, other), horizontal distance to first detection, closest distance, and plant community used. We used the following plant community categories:

Floodplain forest

In or over Bitterroot River

Pond or slough

Streamside riparian

Open grassland

Agricultural

Residential area

Rock outcrop

Restoration

Seed tree shrubby regeneration

Deciduous shrub

Sagebrush

Bitterbrush

Draw with no woody vegetation

Draw with deciduous shrub canopy

Draw with *Populus* sp. canopy

Draw with conifer canopy

Conifer forest

Conifer woodland

Aerial

Unknown

**Summary metrics:**

For several summary metrics, we used data at four-year intervals (2012, 2016, and 2020) when we sampled all 196 points. We calculated native species richness at each point over time, with data to limited to detections < 250 m of the point center. To look at changes in species’ distribution, we calculated the proportion of sampled points species occurred at and calculated the percent change in the proportion at 4-year intervals. This approach allowed us to look at changes for many species where detections were few enough that we could not calculate a good density estimate.

**Density Estimates:**

We used package Distance in R to build models, selected the top model using AIC selection, check model fit, and get density estimates for each species. We used Julian date, minutes since sunrise, observer, and year as covariates with hazard rate and half-normal key detection functions with polynomial and cosine adjustments.

We evaluated precision of density estimates for each species using the calculated coefficient of variation (CV). We considered estimates with a CV value <10 as very good, 10-20 as good, 20-30 is acceptable, and anything >30 is unacceptable due to large confidence intervals and reliability concerns. The “estimate” is an annual estimate of density, reported as birds per km.

**PLANTS**

**Restoration Treatments**

Action items: Philip, Kyle, and Chuck work to describe restoration treatments from 2010 to 2020. See map of the points we are including in this analysis.

Metrics for plant community change:

Some index of woody vegetation change that could capture all points of interest

Philip also mentioned topographic roughness, NDVI, canopy height model

Something for grasslands? Bare ground might help explain decline in Horned Lark?

**Results**

We sampled a maximum of 196 and a minimum of 155 points every year from 2010 to 2020.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| **#Points** | 172 | 191 | 196 | 196 | 196 | 196 | 196 | 155 | 155 | 196 | 196 |

Including 167 species within 250 m of a point. Total abundance within 250 m?

We modeled annual density estimates of the 23 most common species that averaged at least 50 detections a year. We observed significant positive trends for 10 species and a negative trend for one (Horned Lark).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Species** | **Estimate** | **SE** | **t** | **P 2010-2020** | **Trend 2010-2020** |
| Vesper Sparrow | -0.246 | 0.476 | -0.518 | 0.435 |  |
| Western Meadowlark | 0.37 | 0.288 | 1.287 | 0.912 |  |
| Lazuli Bunting | 0.802 | 0.457 | 1.756 | 0.048 | + |
| House Wren | 0.323 | 0.414 | 0.779 | 0.003 | + |
| American Robin | 0.753 | 0.37 | 2.034 | 0.001 | + |
| Grasshopper Sparrow | 2.394 | 0.487 | 4.916 | 0.002 | + |
| Spotted Towhee | 0.463 | 0.201 | 2.302 | 0.122 |  |
| European Starling | -0.011 | 0.135 | -0.079 | 0.7 |  |
| Northern Flicker | 0.256 | 0.076 | 3.383 | 0.009 | + |
| Tree Swallow | 4.703 | 0.916 | 5.136 | 0.011 | + |
| Black-billed Magpie | -0.089 | 0.035 | -2.566 | 0.275 |  |
| Horned Lark | -0.73 | 0.223 | -3.27 | 0.027 | - |
| Mourning Dove | 0.354 | 0.206 | 1.72 | 0.012 | + |
| Brewer's Blackbird | 0.703 | 0.882 | 0.797 | 0.297 |  |
| Bullock's Oriole | 0.189 | 0.127 | 1.492 | 0.078 |  |
| Yellow Warbler | 0.401 | 0.295 | 1.361 | 0.004 | + |
| Eastern Kingbird | 0.418 | 0.114 | 3.671 | 0.08 |  |
| Chipping Sparrow | -0.073 | 0.286 | -0.256 | 0.954 |  |
| Brown-headed Cowbird | 0.65 | 0.235 | 2.759 | 0.136 |  |
| Western Wood Pewee | 0.149 | 0.111 | 1.347 | 0.008 | + |
| American Goldfinch | 3.275 | 1.02 | 3.212 | 0.028 | + |
| Savannah Sparrow | 0.097 | 0.166 | 0.583 | 0.283 |  |
| Brewer's Sparrow | 0.223 | 0.268 | 0.833 | 0.782 |  |

Show figures for several and link to plant community they most occurred in:

For draws: LAZB, HOWR, NOFL

Floodplain: HOWR, AMRO, NOFL, WEWP

Grassland: GRSP, TRES, AMGO, MODO

Nest boxes: TRES, HOWR

Lazuli Bunting

A graph with a line

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House Wren

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American Robin

A graph with a line going up

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Grasshopper Sparrow

Chart, line chart

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Poor buddy Horned Lark

Chart, line chart

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From 2010 to 2015, the average density of the 23 most common native passerines was approximately 10.56 individuals per km2. From 2016 to 2020, the average density increased to about 15.37 individuals per km2.

A graph with lines and numbers

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**Species richness**

Species richness averaged 12.54 (SD = 5.55) in 2012 and 15.96 (SD = 6.45) in 2020 and the net change in species richness per point was 3.42 species (SD 3.85).

From Wyatt

A screenshot of a map

Description automatically generatedA screenshot of a map

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A map with a map of the mountains

Description automatically generated with medium confidenceA map of a landscape

Description automatically generated with medium confidence

**Species Distribution**

**Use Occupancy Modeling to look at changes in distribution? PR?**

We had far more species increase than decrease their distribution between 2012 and 2020.

|  |  |
| --- | --- |
| **Species** | % change between 2012 and 2020 |
| Orange-crowned Warbler | 270 |
| Cedar Waxwing | 238 |
| Red-winged Blackbird | 161 |
| Red Crossbill | 155 |
| Pine Siskin | 150 |
| Brewer's Blackbird | 147 |
| MacGillivray's Warbler | 143 |
| American Goldfinch | 136 |
| Black-headed Grosbeak | 126 |
| Lazuli Bunting | 112 |
| Willow Flycatcher | 90 |
| Lark Sparrow | 89 |
| Gray Catbird | 83 |
| Eastern Kingbird | 69 |
| Grasshopper Sparrow | 68 |
| Tree Swallow | 46 |
| Western Kingbird | 44 |
| Yellow Warbler | 43 |
| Savannah Sparrow | 42 |
| Brown-headed Cowbird | 40 |
| Dusky Flycatcher | 39 |
| Brewer's Sparrow | 37 |
| Bullock's Oriole | 35 |
| Chipping Sparrow | 35 |
| Song Sparrow | 29 |
| Mourning Dove | 28 |
| Western Tanager | 26 |
| Spotted Sandpiper | 25 |
| Killdeer | 22 |
| Western Wood Pewee | 20 |
| House Wren | 16 |
| European Starling | 16 |
| American Robin | 15 |
| Warbling Vireo | 11 |
| Spotted Towhee | 11 |
| Clay-colored Sparrow | 11 |
| Northern Flicker | 1 |
| Yellow-rumped Warbler | 0 |
| Western Meadowlark | -1 |
| Vesper Sparrow | -2 |
| Red-naped Sapsucker | -7 |
| Mountain Bluebird | -18 |
| Northern Harrier | -19 |
| Common Raven | -25 |
| House Finch | -33 |
| Horned Lark | -34 |
| Black-billed Magpie | -39 |
| Red-breasted Nuthatch | -53 |
| Clark's Nutcracker | -73 |
| Long-billed Curlew | -78 |
| Gray Partridge | -81 |

**Plant communities available/used**

The number of plant communities available and used at each point changed over time. In 2012, birds used an average of 3.67 plant communities (SD=1.49) per point while they averaged 4.68 (SD=1.74) in 2020. \*\*It is possible plant communities were present and not used…..do we want to check?

What was/is available?

Key Discussion Points:

Restoration works, but takes time

Bird populations operated on a landscape scales, and isolating plant communities may mask important features of the landscape

Is there anything else we want UMBEL to do?

Do we want to break anything out by plant community?  
Are there better or different metrics to use than species richness?

Are there better or different metrics to use for changes in distribution? Occupancy modeling framework?