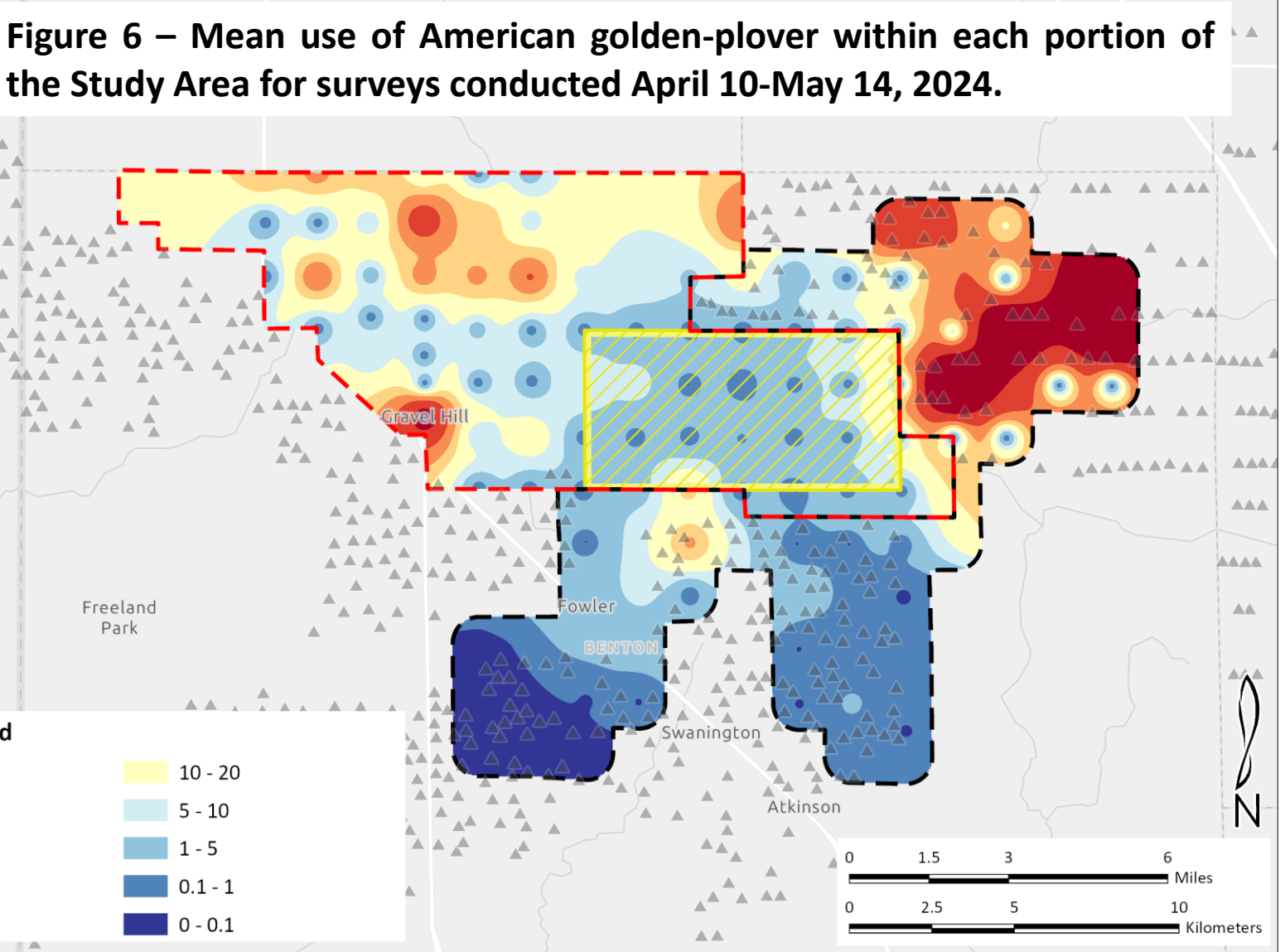
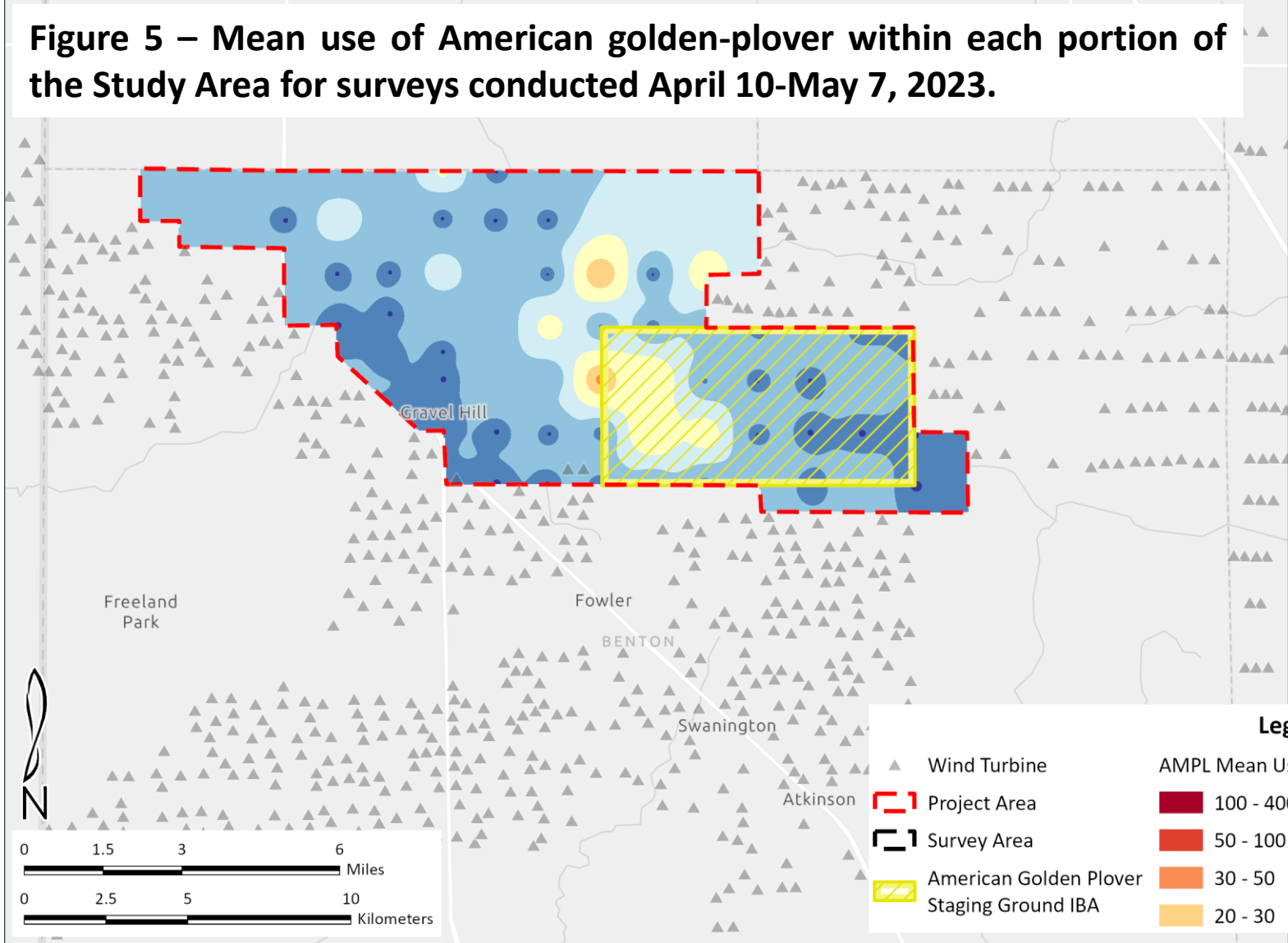


Is American Golden Plover staging/stopover compatible with wind energy?

A Comparison of American Golden Plover (*Pluvalis dominica*) Migratory Stopover Activity in Proximity to Wind Turbines



Intro

The distribution of American Golden plover (AMGP) migratory stopover utilization in relation to wind infrastructure and conservation areas was compared across two years of survey data. In 2023, AMGP use in an area with no wind turbines was compared to an area designated as an Audubon Important Bird Area (IBA; Audubon, 2024). In 2024, additional surveys within adjacent operating wind farms enabled the comparison of stop-over site use within and adjacent to a wind facility. The goals of the surveys were to 1) compare AMGP use between IBA and non-IBA areas, 2) evaluate annual variation in AMGP use of the IBA and non-IBA areas 3) compare AMGP use data between non-turbine and turbine-occupied areas, 4) conduct a displacement analyses similar to Homoya et al. (2017) to determine if or to what extent turbines displace AMGP, and 4) determine if there is a relationship between flock size and proximity to turbines.

Methods

Surveys were conducted from April 10-May 7 in 2023 and from April 10-May 14, 2024, during the spring migration period when AMGP typically arrive and used stopover habitats in western Indiana. The 64 fixed-point count survey locations surveyed in 2023 were surveyed again in 2024 using similar methodology, plus an additional 32 points were surveyed in the Turbine Area in 2024, for a total of 96 points in 2024. Survey locations were spaced approximately one mile apart along 13 north-south transects across the Study Area, distributed along public roads in a spatially balanced approach across the Survey Area (Figure 1). All portions of the study area were dominated by cultivated corn and soybean agriculture.

Biologists drove along county roads throughout the Study Area, stopping at each point for a 2- to 5-minute fixed-point survey for AMGP. Each transect was surveyed three times per week in 2023 and two times per week in 2024, with surveys conducted approximately four days per week during daylight hours and when conditions allowed for optimal viewing of AMGP from each survey point. At each survey point, biologists recorded the following: number of individuals (estimated for large flocks), approximate distance and direction of observation from the point or transect, habitat, wind, weather details, behavior (e.g., perching, flying), flight height, and flight direction. The location information was used to analyze distance and direction of each observation from the nearest operating wind turbines or from random points distributed across the landscape.

Means use (average number of birds observed per survey location per visit within 800m) was modeled to assess interannual differences in use for 2023 and 2024 across IBA and non-IBA areas. Additionally, for 2024, differences in mean use were modeled among the IBA, non-IBA, and turbine-occupied areas. Displacement analyses were conducted to investigate the relative selection of AMGP at different spatial scales relative to turbine proximity. The scales of interest included close-proximity effects (within 100m, 200m and 300m of a turbine) and effects at the turbine/field displacement scale (within 800m). Modeling was performed in a generalized-linear mixed modeling effects framework. The relationship between flock size and distance to nearest turbines was evaluated using a generalized linear mixed effects model.

Results

- Within-year:**
- In 2023, no significant difference in mean use ($P=0.805$) was detected between the IBA and non-IBA areas (Table 1, Figure 2).
 - In 2024, higher mean use ($p=0.002$) was observed in the non-IBA area and Turbine Area ($p=0.001$) compared to the IBA (Table 1; Figure 3).
- Between-year:**
- No significant difference in mean use ($p=0.416$) was documented between years in the IBA.
 - Mean use in the non-IBA was higher ($p<0.001$) in 2024 than in 2023 (Table 1, Fig.2).
- 2024 results:**
- Mean use was higher in the Turbine Area when compared to the IBA ($p<0.001$) and non-IBA ($p=0.153$) areas containing no turbines (Figures 3 and 4).
 - There was no relationship between distance to nearest turbines and flock size ($p=0.66$).
 - Presence of AMGP flocks within 100 m ($p = 0.265$), 200 m ($p = 0.057$), and 300 m of a turbine ($p = 0.115$) was not significantly different between observed AMGP flocks and random points.
 - Distance to turbine did not differ between the AMGP flocks and the random points ($p = 0.532$) or at random points within 800 m of a turbine ($p = 0.694$).

Discussion

Our 2023 and 2024 results suggest that the IBA, designated as important AMGP staging grounds, may have stop-over utilization that is similar to or less than the surrounding landscape, including both areas with and without wind turbines; however, interannual variation may skew this relationship (Figures 5 and 6). Additional years of study may be necessary to confirm the consistency of these activity patterns.

Our 2024 results documented higher AMGP activity in areas with operating turbines than in non-turbine areas (Figure 6), with AMGP flocks being detected as close as 8 meters from operational turbine towers. Additionally, our results suggest that turbines did not displace AMGP migratory stopover activities at various scales; however, the consistency of this pattern may also warrant evaluation with additional years of study.

Our study does not provide support for AMGP avoidance of wind turbines in the region. Results of 2023 and 2024 studies do not provide evidence that the IBA has greater AMGP activity than the surrounding areas, both within and outside operating wind energy projects. Replication of the 2024 study design may yield additional information to further understand AMGP stop-over site distribution in relation to wind infrastructure and improve understanding of the drivers of habitat selection.

Figure 1 –Wind Farm Area of Interest, American Golden Plover Important Bird Area, Turbine Areas and survey point locations at a proposed Wind Project, Benton Co., Indiana, for surveys conducted in 2023 and 2024

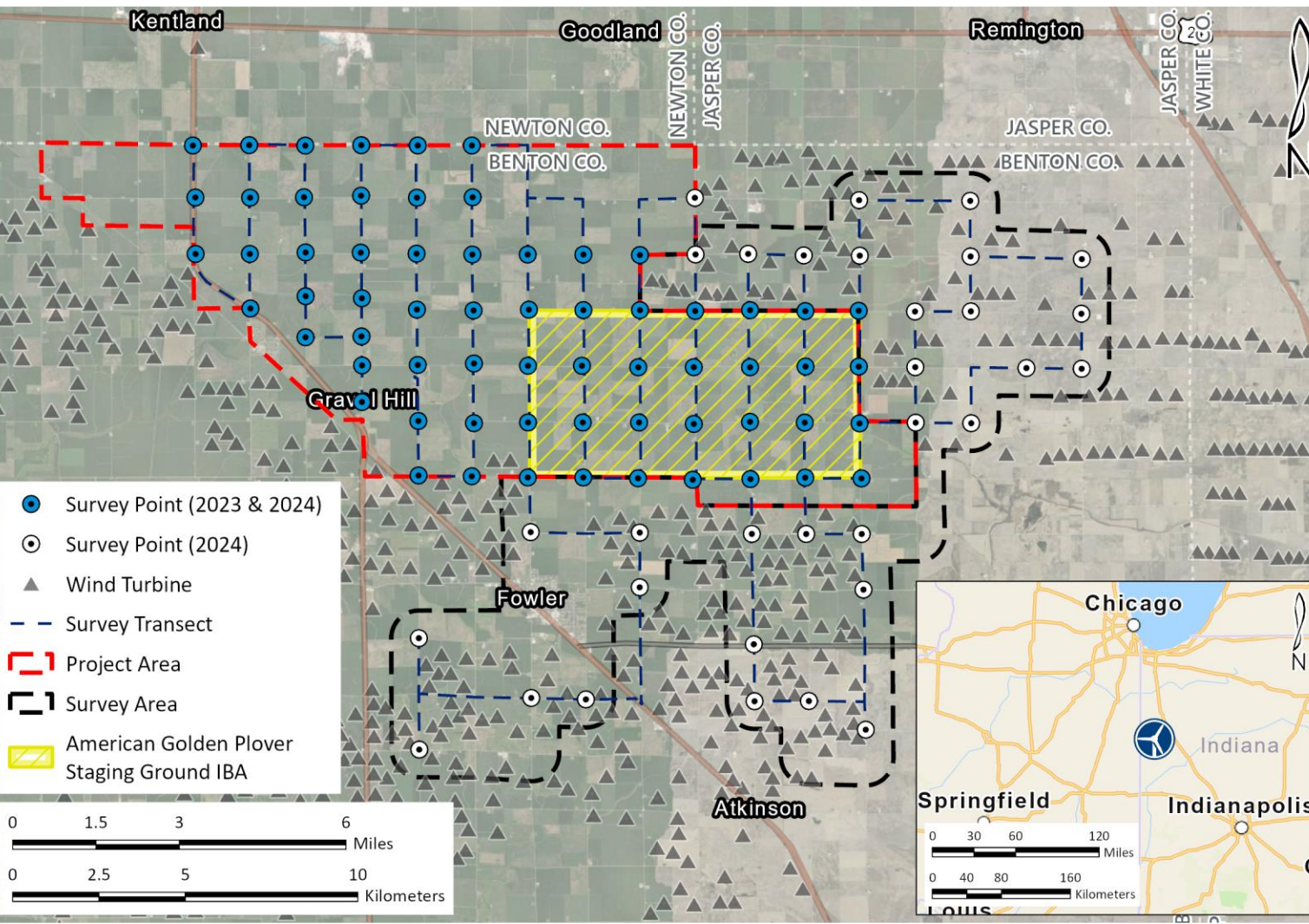


Table 1. Comparison of groups, individuals, and mean use of American golden plover in 2023 and 2024.

Year	Area	# of Groups	# of Individuals	Mean Group Size	Modeled Mean Use
2023	AOI	58	2,759	47.6	1.32
	IBA	25	1,297	51.9	1.37
	Non-IBA AOI	33	1,462	44.3	1.26
2024	AOI	72	6,821	94.7	1.68
	IBA	10	460	46.0	0.50
	Non-IBA AOI	62	6,361	102.6	2.86
	Turbine Area	37	12,285	332.0	3.75

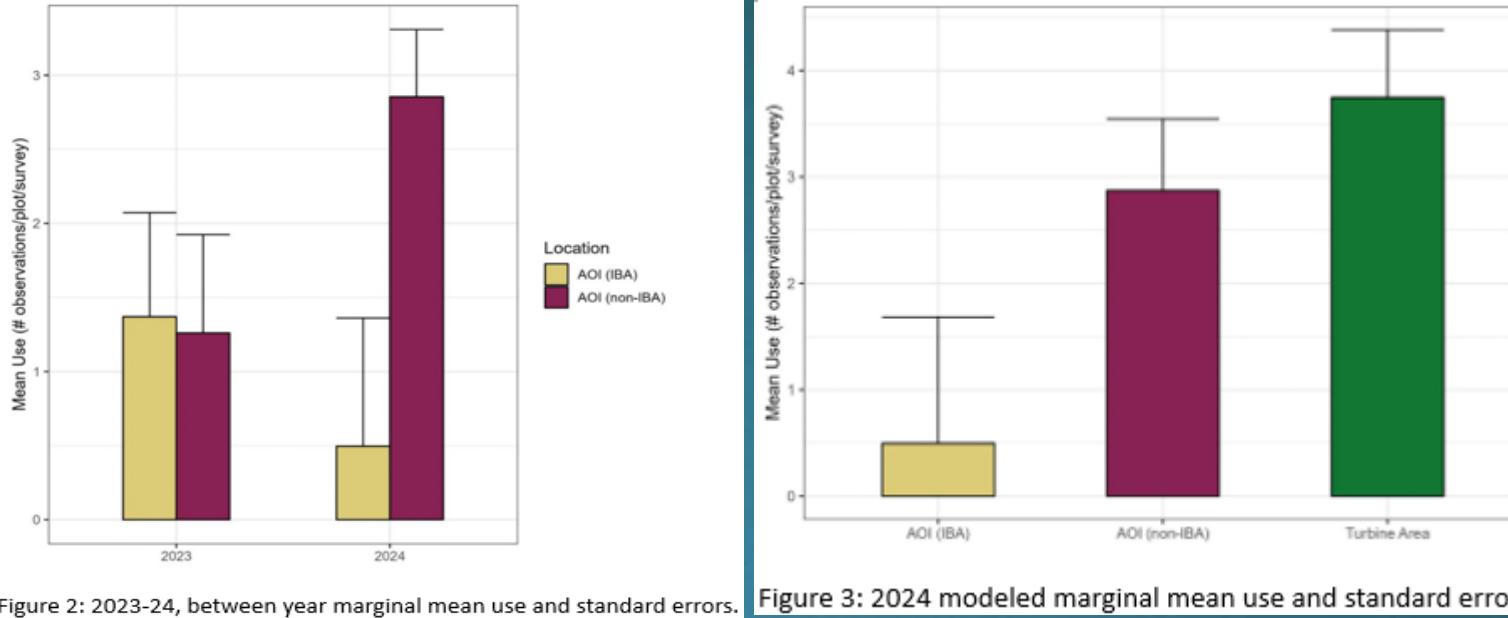
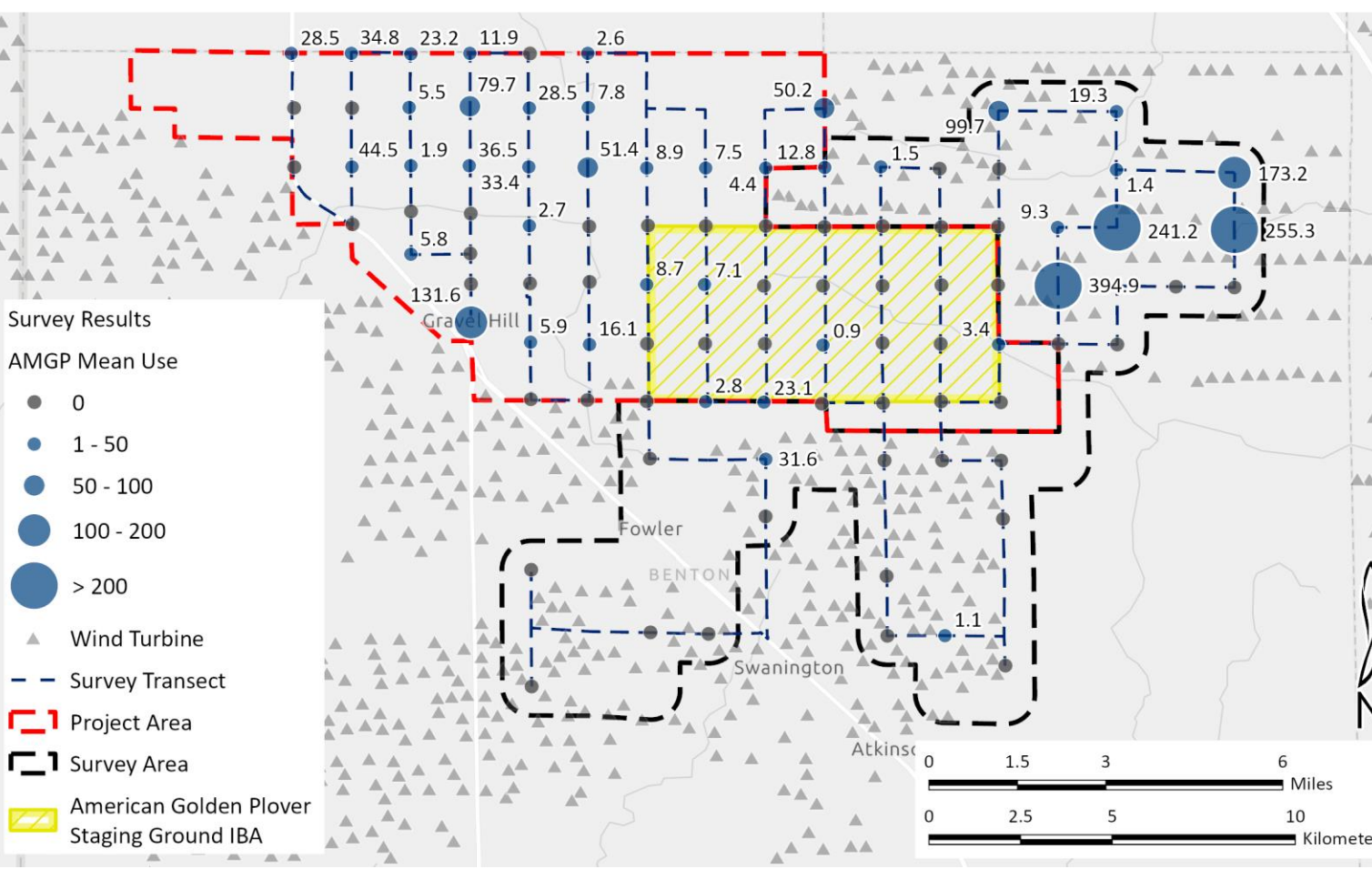


Figure 4 – Mean use at American golden-plover survey points within each portion of the Study Area for surveys conducted April 10 – May 14, 2024.




References

Homoya, W., J. W. Moore, P. J. Puhl, and J. B. Dunning, Jr. 2017. Do American Golden-Plovers (*Pluvialis dominica*) Avoid Wind-Energy Turbines in Agricultural Fields in Indiana During Spring Migration? *Wilson Journal of Ornithology* 129(4): 863-871. doi: 10.1676/15-134.1.


National Audubon Society (Audubon). 2024. American Golden-Plover Stopover Staging Grounds: Site Id 2563. Audubon, New York, New York. Accessed July 2024. Available online: <https://gis.audubon.org/portal/apps/dashboards/1742bc47f980490da9c23e23dc4d5e86#site=2563>

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