

2023 Karner Blue Butterfly Summer Survey Results

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MONITORING:

Within the WDNR Karner blue butterfly Recovery Program, monitoring throughout the Karner's range consists of two types of survey efforts; population surveys, which are conducted using a highly intensive survey method (distance sampling) and occupancy surveys, which are conducted using less intensive survey methods (occupancy-presence/absence) (Figure 1). Population surveys allow us to view a snapshot of what a specific site population level is estimated to be at that point in time. Occupancy surveys allow us to survey a greater number of sites and estimate the occupancy, detection, colonization and local extinction rates of the species. These estimates give us a larger picture view of the species health and its metapopulation dynamics across the state.

Population Surveys (distance sampling):

In 2023, 229 acres across 7 sites in 6 counties were surveyed using the higher intensive survey method of distance sampling to estimate local population size (Figure 1). A total population of 10,460 individuals was estimated on those 229 acres (Table 1A). The number of individuals estimated is highly dependent on the effort, or number of acres surveyed, which varies annually, meaning these numbers are not directly comparable. For example, in 2023, only half the typical number of sites were sampled. In 2024, the other half of those sites will be surveyed.

To examine trends across years and among sites we calculate the number of butterflies estimated per acre surveyed. When comparing butterflies per acre, we saw a 152% decrease in the total estimated number of butterflies per acre compared to 2022 (Figure 2). BUT this estimate includes the Sandhill site, which is the largest Karner population we monitor and an outlier when compared to the rest of the sites. So, to get a more accurate idea of the change of butterflies per acre, we removed the Sandhill factor and found a 37% decrease in the total estimated number of butterflies per acre compared to 2022 (Figure 3). The number of butterflies per acre in 2023 was low, ranking 14th in the last 16 years of data collection (Figure 2). In 2023,

the estimated number of butterflies per acre (46) fell below the average number of individuals (93) over the study period. Populations throughout the state fluctuate every year, meaning not every population will increase/decrease at the same time/rate. Each of the properties surveyed have been broken down into estimated butterflies per acre surveyed and can be found in the Appendix.

2023 Karner Surveys

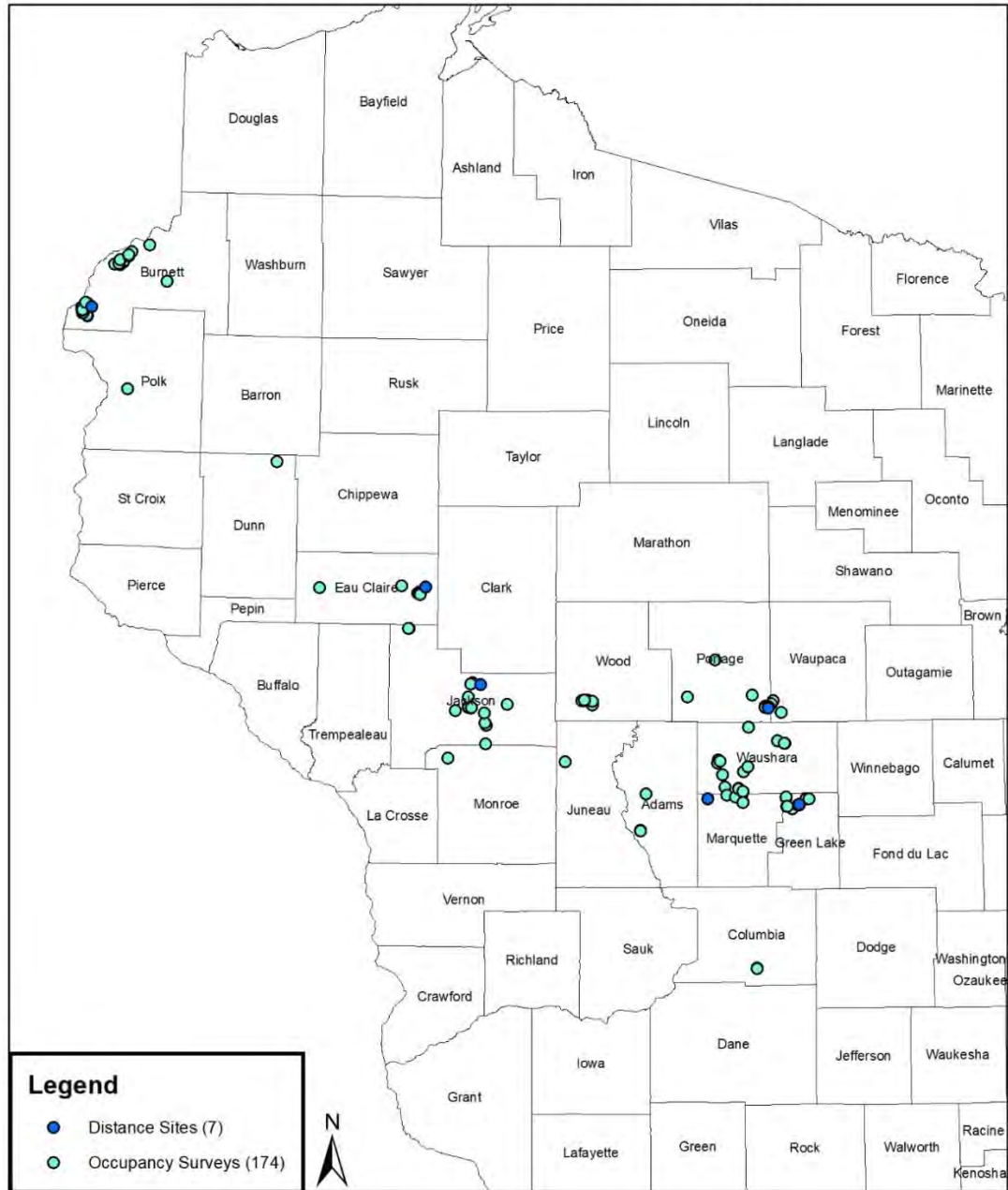


Figure 1. Wisconsin Karner Blue Butterfly Recovery Program monitoring effort in 2023.

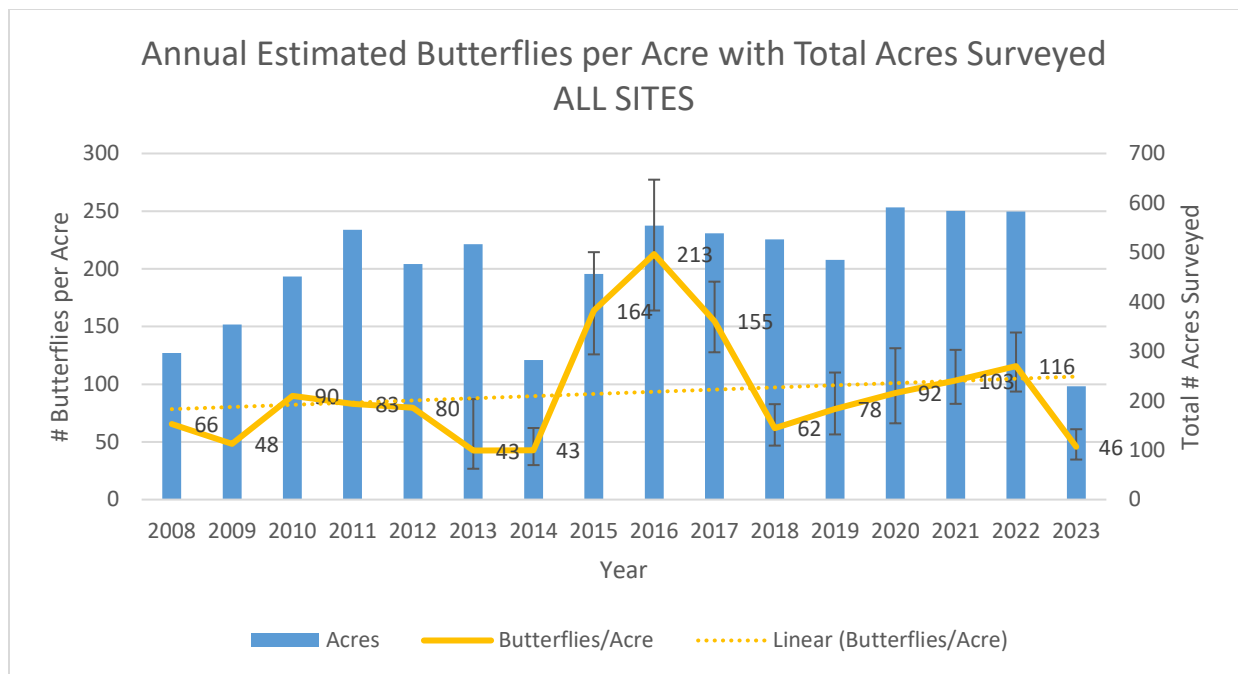


Figure 2. Annual estimated number of Karner blue butterflies per acre surveyed at all sites with 95% confidence levels. Dashed line represents linear trendline.

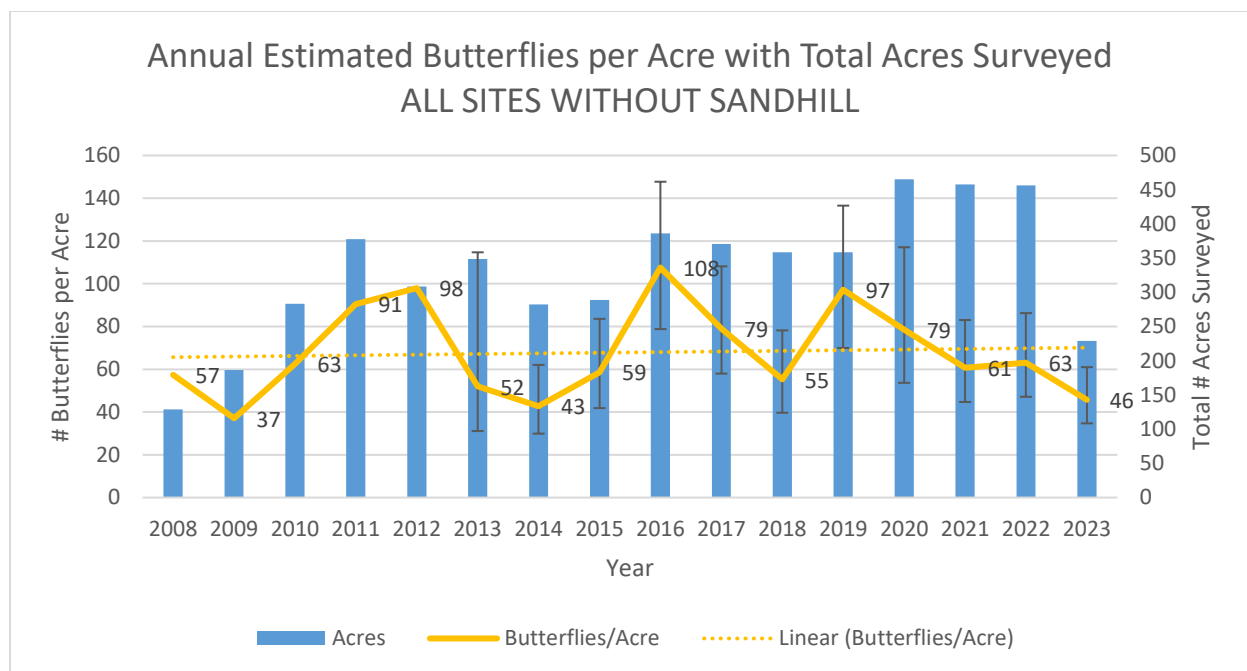


Figure 3. Annual estimated number of Karner blue butterflies per acre surveyed at all sites with 95% confidence levels. Dashed line represents linear trendline.

Occupancy Surveys:

For the 2023 field season, over 368 acres were surveyed using the lower intensive sampling method. These observations come from a variety of sources including Habitat Conservation Plan (HCP) related surveyors (including WDNR), contract crews, and participants in the [Karner Volunteer Monitoring Program](#). A total of 174 observations were submitted. Volunteer data submissions increased this year with 36% of the total observations coming from volunteers. Contracted crews submitted 45%, and HCP surveys contributed 19%. Volunteers contributed 120 hours of field time to Karner surveys. Observers visited 100 sites in 2023 and of those, 78 sites had Karners present making the Naïve Occupancy 0.78 for 2023.

Utilizing these data, we can estimate occupancy rate (proportion of sites that are occupied), colonization rate (proportion of successful colonizations of unoccupied sites), and local extinction rate (proportion of formerly occupied sites becoming unoccupied). Based on these data, Karners are found to be consistently detectable at 0.9 (Table 1). Probability of extinction is 0.06, whereas colonization probability is 0.42 suggesting Karners are persisting within their Wisconsin habitats (Table 1). Occupancy probability is calculated each year and was slightly lower this year at 0.85 than in 2022 (Figure 4).

One shortcoming of these data is the low number of repeated sites surveyed. Only 3 sites have been surveyed every year for the last 5 years. Eleven sites have been surveyed every 4 years, 39 sites have been surveyed every 3 years, and 61 sites have been surveyed every 2 years. The rest of the sites have been surveyed only once. This lack of repeated sampling may contribute to a reduced confidence in the detection, extinction, and colonization estimates. Site selection is also biased and non-random which can affect confidence (skewing occupancy and detection probability results higher). It is our intention to formalize the Karner monitoring program, pending funding, to build a more statistically robust Karner Metapopulation Monitoring Pilot Program.

Table 1. Detection, extinction, and colonization rates with standard error estimated from 2018-2023 data.

2018-2023		
Parameter	Estimate	Standard Error
Detection Probability	0.898	0.0151
Extinction Probability	0.0593	0.0196
Colonization Probability	0.416	0.0932

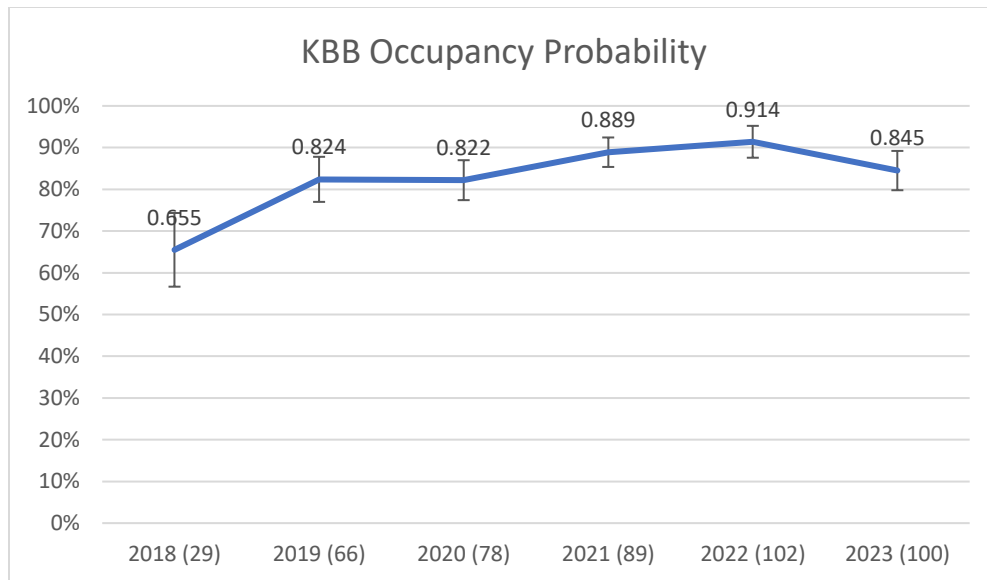


Figure 4. Annual Karner occupancy probability with standard error calculated in R. Number in parentheses represent number of sites surveyed per year.

In conclusion, despite low Karner estimates at the distance sampling sites, colonization and extinction rates appear good. A contributing factor to the reduced population estimates is likely the hot dry drought summer in 2023. It is common for butterfly populations to fluctuate annually so a decline every now and then is likely not a major cause for concern. Continued monitoring will determine the duration and extent of current trends.

Interested in joining the Karner Volunteer Monitoring Program?
Click [here](#) to learn more or e-mail Chelsean.Weinzinger@wisconsin.gov to sign up!

FUN FINDS!



A volunteer in Eau Claire County shared this exciting find! Dozens of Karners puddling on her dog's toy. Perhaps enjoying the salts & minerals from her dog's slobber? 07/18/2023 (Bev Stelljes)



Another volunteer submitted an observation of multiple Karners in Dunn county. Based on our data, we believe this is the first record of Karners in this county! 7/25/2023 (Bob Lefevre)

We also had a volunteer submit an observation from Eau Claire county, which was found to be the western most site to have Karners in the county! 7/8/2023 (Karen Voss)



Appendix

Table 1A. Karner population estimate per recovery property. Estimates are not directly comparable due to varying number of acres surveyed each year. Note that 2023 was the first year in which a new sampling approach was instituted where only half of the sites will be visited each year, leading to a much smaller overall estimate.

WI KBB Population Estimate by Recovery Property							
RU	Property	2018	2019	2020	2021	2022	2023
GL	Sandhill W.A.	12,692	3,159	18,066	32,504	38,533	-
MS	Emmons Creek F.A.	1,629	4,173	3,933	1,939	1,224	370
	Hartman Creek S.P.	-	-	-	-	-	-
	Welch	3,183	10,154	5,361	5,660	9,487	5,306
	Greenwood W.A.	-	-	-	-	-	-
	White River W.A.	1,987	6,124	1,560	3,286	4,108	2,795
	Private Property 1	2,356	2,433	4,973	3,058	1,521	353
	Private Property 2	1,860	3,889	1,487	2,140	8,105	-
	Private Property 3	1,030	1,677	1,093	-	-	-
WCD	Black River S.F.	5,375	4,852	6,568	2,476	799	606
	Bauer Brockway SNA	372	0	569	1,209	446	-
SO	Crex Meadows W.A.	871	355	2,935	2,430	156	-
	Fish Lake W.A.	1,186	1,216	3,006	2,256	498	640
ESP	Canoe Landing Prairie SNA	-	-	2,203	1,567	1,153	390
	Coon Fork Barrens SNA	-	-	2,816	1,779	1,284	-
Total Population Estimate		32,541	38,032	54,570	60,304	67,314	10,460

A map of Wisconsin showing its 9 counties color-coded by water quality index. The legend indicates the following categories:

- WCD (Water Quality Data): Light blue
- SO (Surface Oxygen): Light green
- MS (Mean Score): Pink
- GL (Great Lakes): Purple
- ESP (Eutrophication Score): Light green

The map shows the following county assignments:

- WCD (Light blue):** Jackson, Trempealeau, Buffalo, La Crosse, Monroe, Juneau, Adams, Marquette, Waushara, Waubesa, Portage, Wood, Marathon, Lincoln, Taylor, Rusk, Barron, Polk, St. Croix, Pierce, Pepin, Eau Claire, Clark, Chippewa, Dunn, Burnett, Washburn, Sawyer, Price, Oneida, Forest, Florence, Vilas, Iron, Ashland, Bayfield, Douglas.
- SO (Light green):** Burnett, Washburn, Sawyer, Price, Oneida, Forest, Florence, Vilas, Iron, Ashland, Bayfield, Douglas.
- MS (Pink):** Waushara, Waubesa, Portage, Wood, Marathon, Lincoln, Taylor, Rusk, Barron, Polk, St. Croix, Pierce, Pepin, Eau Claire, Clark, Chippewa, Dunn, Burnett, Washburn, Sawyer, Price, Oneida, Forest, Florence, Vilas, Iron, Ashland, Bayfield, Douglas.
- GL (Purple):** Waushara, Waubesa, Portage, Wood, Marathon, Lincoln, Taylor, Rusk, Barron, Polk, St. Croix, Pierce, Pepin, Eau Claire, Clark, Chippewa, Dunn, Burnett, Washburn, Sawyer, Price, Oneida, Forest, Florence, Vilas, Iron, Ashland, Bayfield, Douglas.
- ESP (Light green):** Burnett, Washburn, Sawyer, Price, Oneida, Forest, Florence, Vilas, Iron, Ashland, Bayfield, Douglas.

West Central Driftless Recovery Unit (WCD)

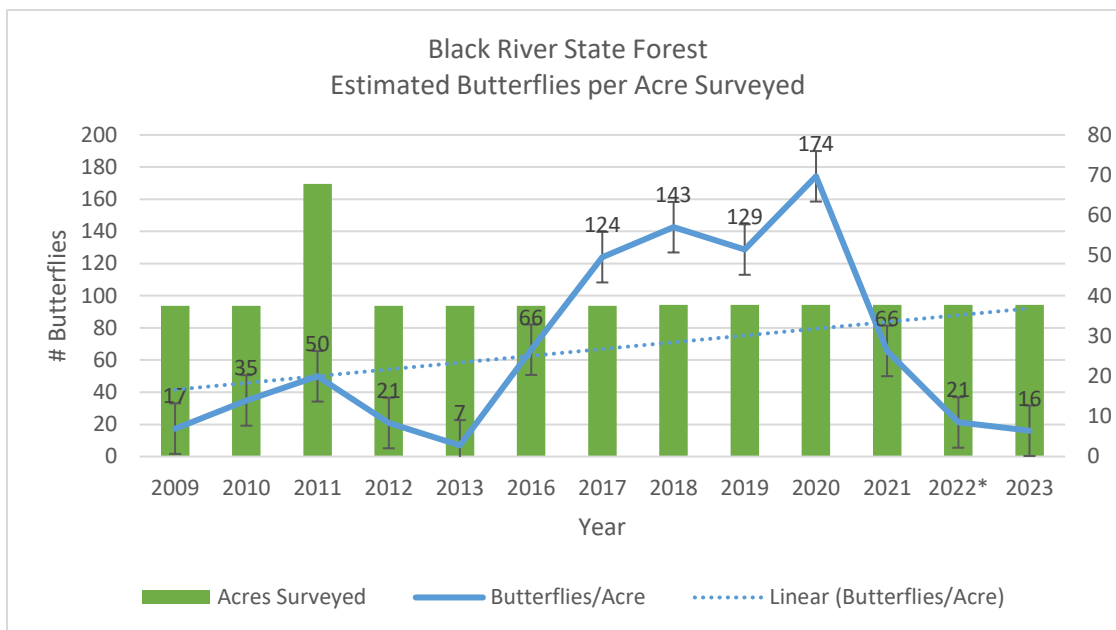


Figure 2A. Annual estimated number of Karner blue butterflies per acre surveyed the Black River State Forest with confidence levels. Dashed line represents linear trendline. Some estimates come from years where model assumptions were violated, making them less reliable (starred years).

Escarpment & Sandstone Plateau Recovery Unit (ESP)

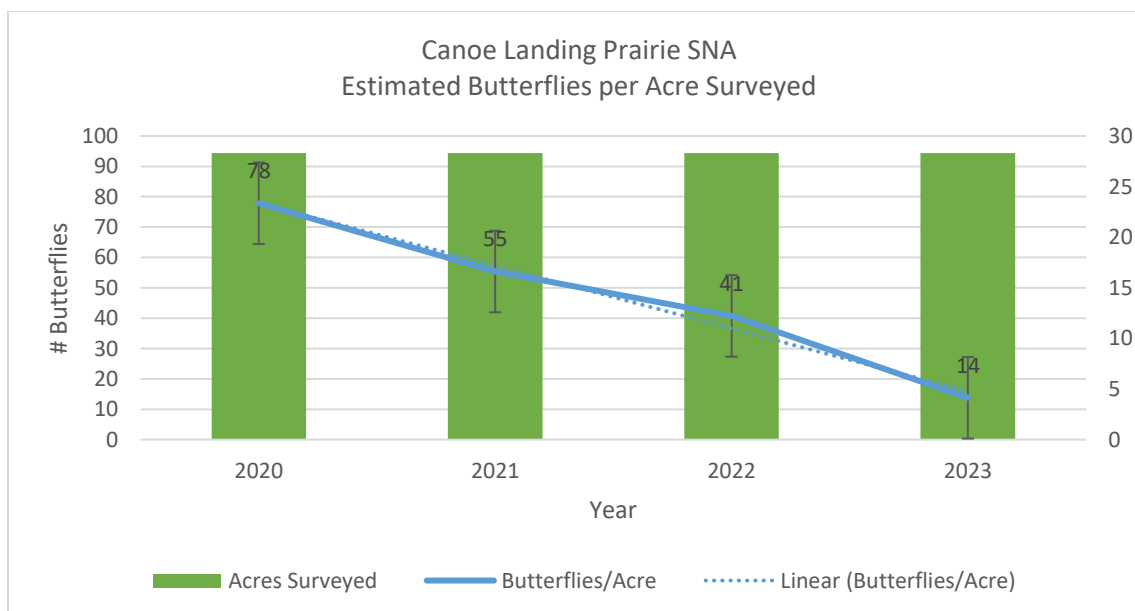


Figure 3A. Annual estimated number of Karner blue butterflies per acre surveyed at Canoe Landing Prairie State Natural Area with confidence levels. Dashed line represents linear trendline.

Superior Outwash Recovery Unit (SO)

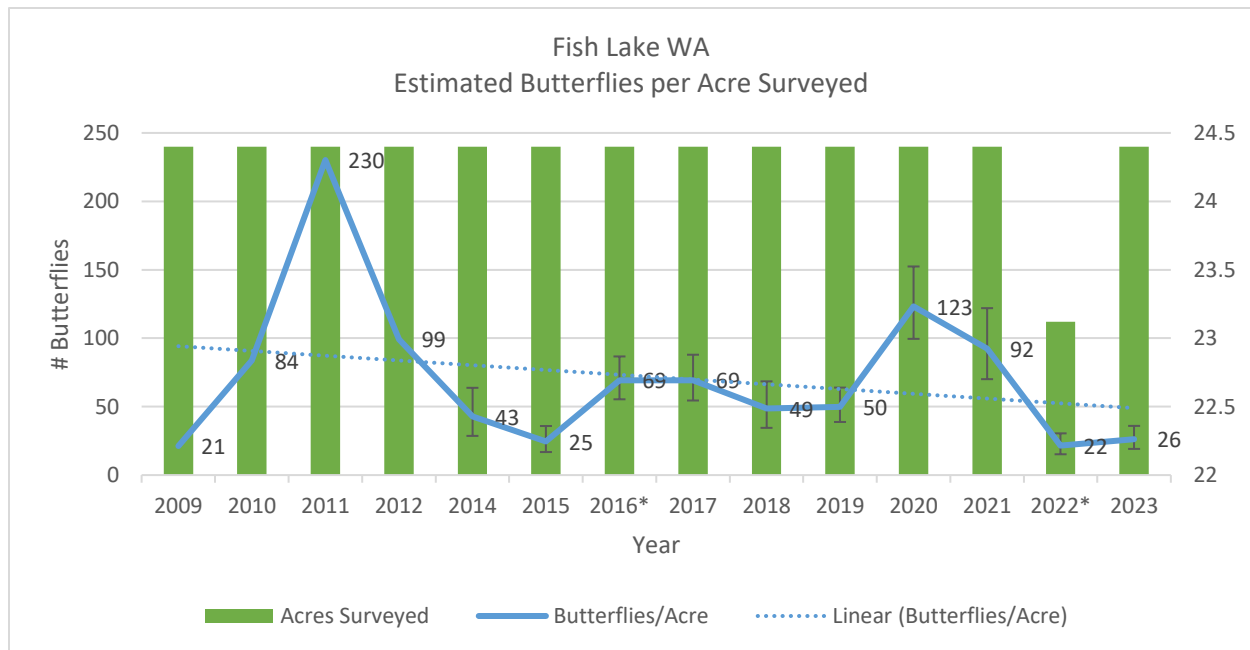


Figure 4A. Annual estimated number of Karner blue butterflies per acre surveyed at Fish Lake Wildlife Area with confidence levels. Dashed line represents linear trendline. Some estimates come from years where model assumptions were violated, making them less reliable (starred years).

Morainal Sands Recovery Unit (MS)

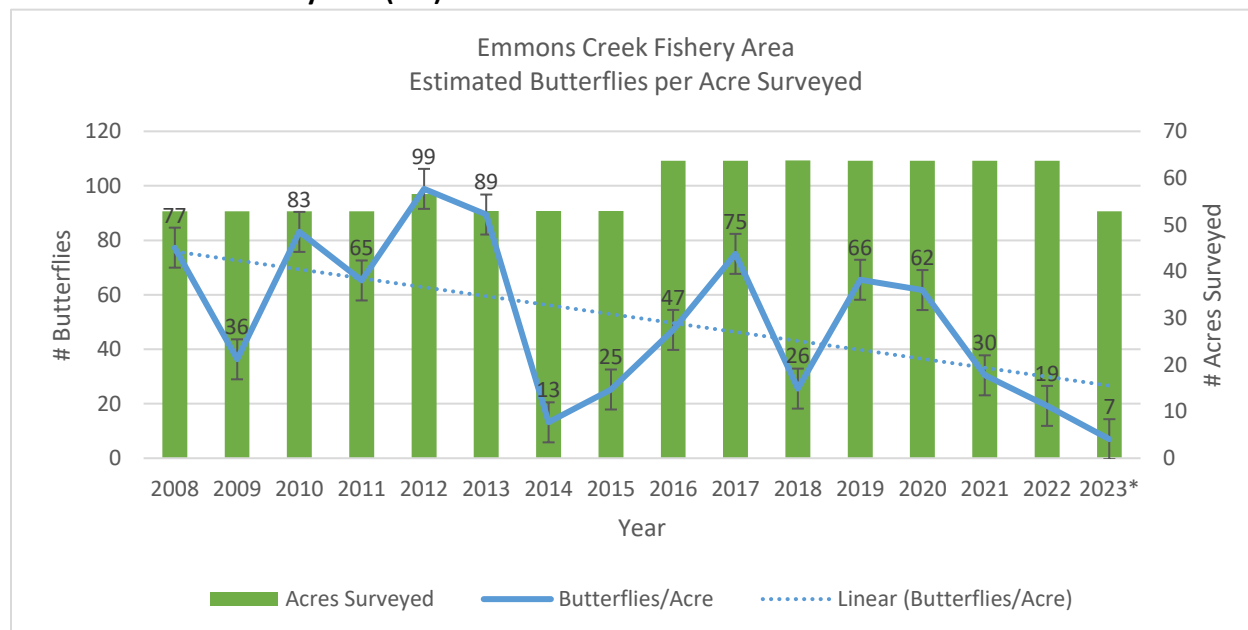


Figure 5A. Annual estimated number of Karner blue butterflies per acre surveyed at Emmons Creek Fishery Area with confidence levels. Dashed line represents linear trendline. Some estimates come from years where model assumptions were violated, making them less reliable (starred years).

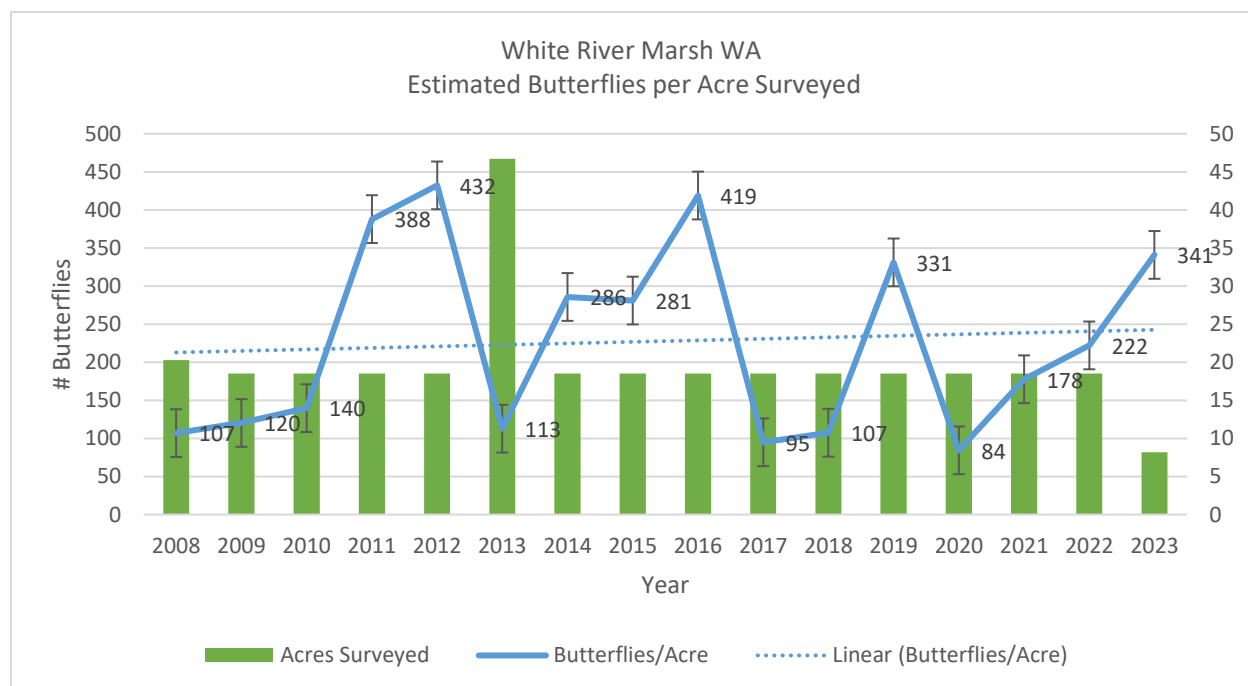


Figure 6A. Annual estimated number of Karner blue butterflies per acre surveyed at White River Marsh Wildlife Area with confidence levels. Dashed line represents linear trendline.

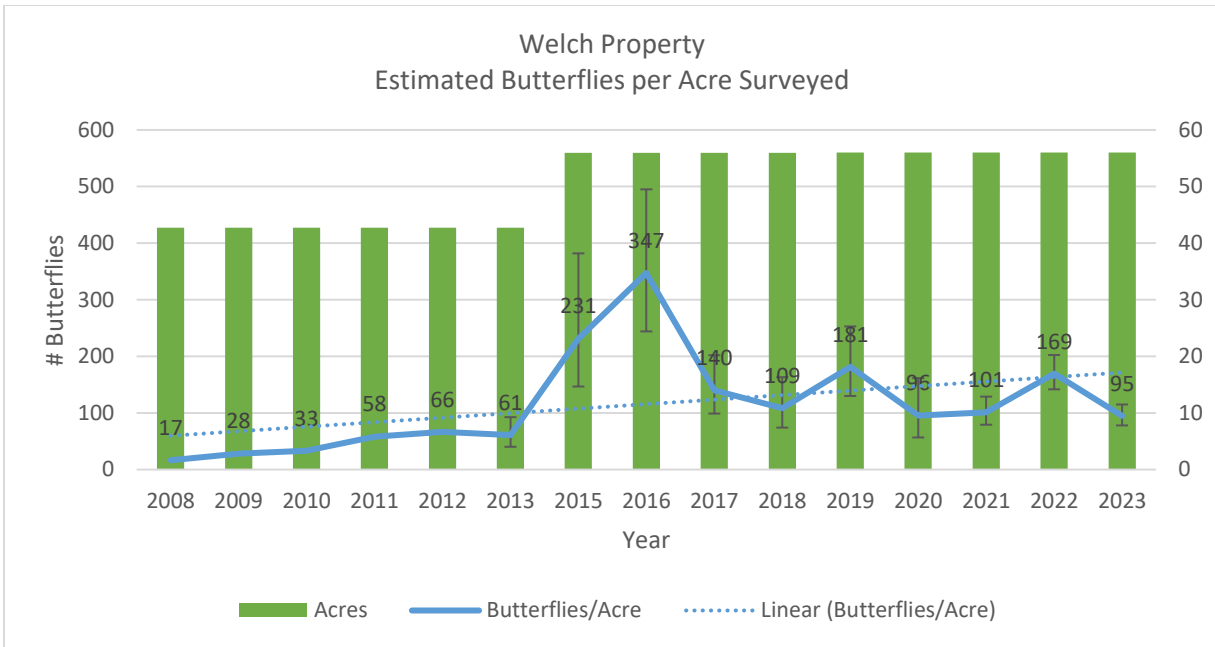


Figure 7A. Annual estimated number of Karner blue butterflies per acre surveyed at Welch Property with confidence levels. Dashed line represents linear trendline.

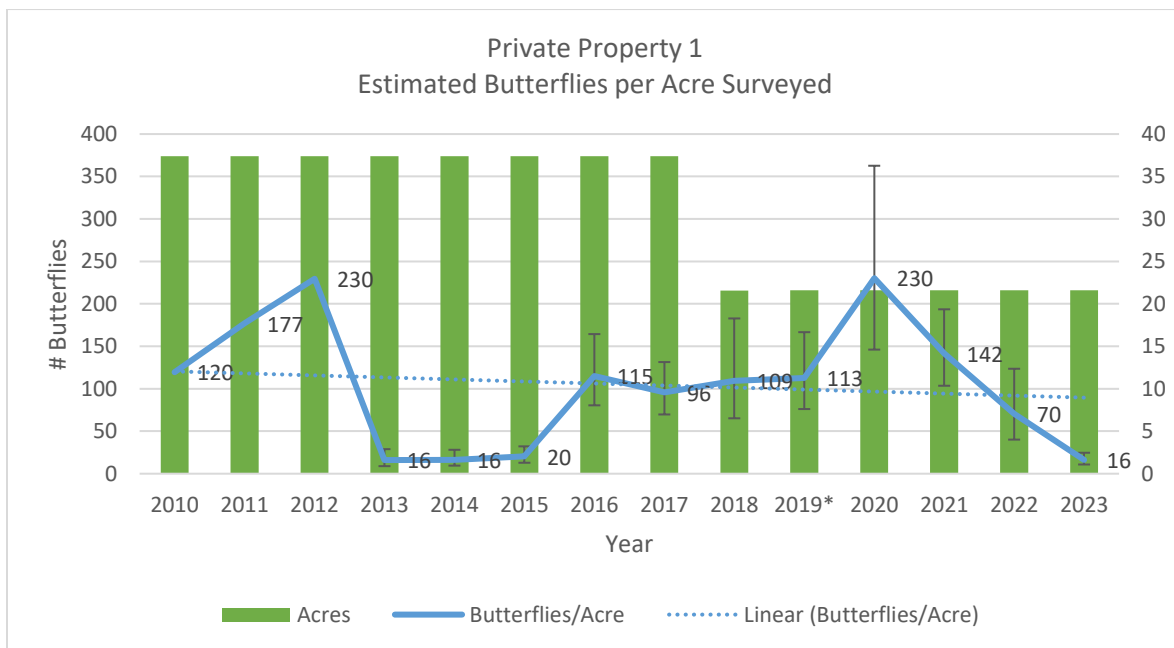


Figure 8A. Annual estimated number of Karner blue butterflies per acre surveyed at Private Property #1 with confidence levels. Dashed line represents linear trendline.