**Breeding Bird Monitoring Protocol for the Heartland Inventory and Monitoring Network**

**Standard Operation Procedure 3: Establishing and Marking Sampling Plots**

**Version 3.00 (05/03/2019)**

**Revision History Log:**

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| Previous Version # | Revision Date | Author | Changes Made | Reason for Change | New Version # |
| 1.00 | Jun. 2004 | D.G. Peitz | Add sample year column to Table 4.01.1 | Edited to reflect changes in the annual sampling effort at TAPR | 1.01 |
| 1.01 | May 2008 | D.G. Peitz | Entire document | Edited to reflect that bird monitoring has been expanded to ten additional network parks | 2.00 |
| 2.00 | May 2019 | D.G. Peitz | Updated throughout to NRR format. | Made SOP NRSS compliant. | 3.00 |
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This Standard Operating Procedure explains the procedure for establishing and marking sampling plots that all observers should follow when locating survey plots or adding new plots in network parks.

**I. Procedures:**

1. Permanent sampling locations, or 'plots', were selected by overlaying a systematic virtual grid (originating from a random start point) on a park map (Appendix A of Narrative). Systematic sampling across a park allows us to make park-wide inferences concerning the avian community. Grid size varied by park based on the size of the unit (Table 3.01). By increasing the number of sites at which bird observations are made on small parks, we increase the likelihood that rare birds present at the park will be observed. Using smaller grids in smaller park units also increases the overall number of bird observations, and thus more accurate estimates of abundance for all species can be made. This is advantageous, as many birds are uncommon or cryptic and may be represented by only one or few sightings (or not seen at all in some years), making it difficult to interpret situations where one individual was present in year one, but none in year two. Also, at some parks not all systematically chosen plots can be sampled, as some fall in culturally sensitive areas or in areas too dangerous or impractical to sample. Therefore, these plots have been removed from the suite of points to sample. At large parks, the number of sampling locations is not an issue, and sampling the number of plots generated by smaller grids would be cost prohibitive.

The orientation of the systematic grid was rotated from north 45 degrees at: Arkansas Post National Memorial, Arkansas (ARPO); George Washington Carver National Monument, Missouri (GWCA); Homestead National Monument of America, Nebraska (HOME); Lincoln Boyhood National Memorial, Indiana (LIBO); Pea Ridge National Military Park, Arkansas (PERI); Pipestone National Monument, Minnesota (PIPE); and Wilson’s Creek National Battlefield, Missouri (WICR) to prevent sampling sites from being influenced by man-made features (roads, fences, etc.) oriented along cardinal directions. The systematic grid at Effigy Mounds National Monument (EFMO) and Herbert Hoover National Historic Site (HEHO), Iowa were rotated from north 8 and 52 degrees, respectively, to match existing vegetation grids. The angle of the sampling grid at Tallgrass Prairie National Preserve (TAPR), Kansas was selected randomly (34 degrees from north). The unique shapes of the different units at Hopewell Culture National Historical Site (HOCU), Ohio dictated that the systematic grid be oriented using cardinal directions.

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| Table 3.01. Sample grid sizes for parks in the Heartland Inventory and Monitoring Network. | |
| Park | Grid size |
| Arkansas Post National Memorial, Arkansas | 200 m x 200 m |
| Effigy Mounds National Monument, Iowa | 400 m x 400 m |
| George Washington Carver National Monument, Missouri | 100 m x 100 m |
| Herbert Hoover National Historic Site, Iowa | 100 m x 100 m |
| Hopewell Culture National Historical Site, Ohio | 400 m x 400 m |
| Homestead National Monument of America, Nebraska | 100 m x 100 m |
| Lincoln Boyhood National Memorial, Indiana | 100 m x 100 m |
| Pea Ridge National Military Park, Arkansas | 400 m x 400 m |
| Pipestone National Monument, Minnesota | 100 m x 100 m |
| Tallgrass Prairie National Preserve, Kansas | 400 m x 400 m |
| Wilson’s Creek National Battlefield, Missouri | 400 m x 400 m |

1. At TAPR, the riparian corridor was identified as a separate stratum, with sampling extending 125 m on either side of the stream channel (Palmer and Fox Creeks). The riparian stratum makes up 5.3% of the total park area (4398 ha) at TAPR. Within the riparian stratum, plots were located at 250 m intervals along the extent of the stream. Plots were placed 10 m south of the stream channel on west-east flowing streams (Palmer Creek) and 10 m west of north-south flowing streams (Fox Creek). Any plots from the overall park grid that fell within the riparian stratum were discarded. This site selection approach allows flexibility to choose the appropriate reference frame to answer different monitoring questions. When making park-wide inferences, estimates for the two strata will be combined according to each strata's proportionate area contribution to give an overall park mean and variance. At the same time, more intensive sampling in the riparian corridor will ensure an adequate sample to describe habitat relationships specific to this less common, but important, stratum. The systematic grid will also allow us to limit the reference frame appropriately when asking more specific monitoring questions (e.g. only those sampling plots within particular management units would be used to compare the avian response to different fire or grazing regimes).
2. Park maps indicating plot locations and plot ID numbers are printed prior to the start of the field season to assist in tracking completion of the work and navigating from point to point. Park maps with bird point locations are included in Appendix A of the Narrative.
3. During bird surveys, sampling plots are located using a GNSS unit and temporarily marked with 36-in pin flags if it is a year in which habitat assessment is to be done to aid in re-locating the point for habitat assessment. Warning: grazing ungulates sometimes eat pin flags, a problem that increases with time between the bird survey and habitat work on a plot. Therefore, if habitat surveys are done on a day separate from the bird surveys, the point will not be marked with a pin flag, and the habitat crew will locate the plots using a GNSS unit and mark it with a surveyor’s pin to use during habitat assessments. Pin flags are collected from a plot once the habitat work for that plot is completed. Each year, the sampling plots are located again using a GNSS unit, eliminating the need for permanent marking of each point.

Note: All UTM coordinates (waypoints) should be entered into the GNSS unit prior to the start of the field season. The appropriate UTM zones and UTM coordinates for all survey plots at each Heartland Inventory and Monitoring Network park are included in Appendix B of the Narrative. Waypoints for bird plots are stored on the Heartland Inventory and Monitoring Network server in the *SpatialInfo* folder of the *GrasslandBirds* project folder.