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Hanford Site Bird Surveys Report for Calendar Year 2016

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management
Contractor for the U.S. Department of Energy
under Contract 89303320DEM000031

HANFORD MISSION INTEGRATION SOLUTIONS

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Hanford Mission Integration Solutions

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1.0 Introduction

Resource stewardship is an integral part of the U.S. Department of Energy, Richland Operations Office (DOE-RL) responsibilities at the Hanford Site. Efficient conservation or management of any species or any population is supported through the availability of reliable information on the population in question. DOE-RL conducts ecological monitoring on the Hanford Site to collect and track this information. Ecological monitoring data provide baseline information about the plants, animals, and habitat under DOE-RL stewardship at Hanford that is required for decision-making under the *National Environmental Policy Act* (NEPA) and *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA). The *Hanford Site Comprehensive Land Use Plan* (CLUP, DOE/EIS-0222-F), which is the Environmental Impact Statement for Hanford Site activities, helps ensure that DOE-RL, its contractors, and other entities conducting activities on the Hanford Site are in compliance with NEPA.

1.1 Guidance and Regulatory Drivers

The *Hanford Site Biological Resources Management Plan* (BRMP, DOE/RL 96-32) is identified by the CLUP as the primary implementation control for managing and protecting natural resources on the Hanford Site. According to the CLUP,

> "the BRMP *provides a mechanism for ensuring compliance with laws protecting biological resources; provides a framework for ensuring that appropriate biological resource goals, objectives, and tools are in place to make DOE an effective steward of the Hanford biological resources; and implements an ecosystem management approach for biological resources on the Site. The BRMP provides a comprehensive direction that specifies DOE biological resource policies, goals, and objectives.*"

DOE-RL places priority on monitoring those plant and animal species or habitats with specific regulatory protections or requirements, that are rare and/or declining (federal or state listed endangered, threatened, or sensitive species), or are of significant interest to federal, state, tribal governments, or the public. The BRMP ranks wildlife species and habitats from Level 5 (highest priority) to Level 0 (lowest priority), providing a graded approach to monitoring biological resources based on the level of concern for each resource. Current monitoring of bird species and habitats on the Hanford Site span a range of BRMP resource levels from maintaining protective buffers around Ferruginous Hawk (*Buteo regalis*) nest sites (Level 4), Bald Eagle (*Haliaeetus leucocephalus*) nest and night roost sites (Level 4), and burrowing owl nest sites (Level 3), to safeguarding migratory bird nest locations in Level 0 habitat. The roadside bird surveys support the obligations described in the Memorandum of Understanding between the U.S. Department of Energy's (DOE) and the United States Fish and Wildlife Service (USFWS) *Regarding the Implementation of Executive Order 13186,* "*Responsibilities of Federal Agencies to Protect Migratory Birds*" by conducting research and other activities for the preservation and enhancement of habitat for migratory birds, maintenance of bird populations, and minimization of human impacts on native species.

1.2 Background

The Hanford Site lies within the semi-arid Pasco Basin of the Columbia Plateau in southeastern Washington State. The DOE Hanford Site is unique in that public access is restricted, there is little ongoing industrial development outside of the Central Plateau, and agricultural activities do not occur within its boundaries. The Hanford Site contains a variety of bird habitats that include: basalt outcrops, riparian zones along streams and springs, shrub-steppe on slopes and plains, sand dunes and blowouts, and abandoned fields or disturbed areas (PNL-8942). The Hanford Site provides large expanses of habitat for shrub-steppe birds and other landbirds that depend on either mature stands of sagebrush or areas with at least some component of native grasses in the understory (TNC 1999). Conversely, the riparian areas of the Hanford Site may

have been improved by larger trees planted near homesteads and towns, which, in turn provide nesting locations, feeding areas, and roosting spots for many species.

The quanity and quality of shrub-steppe habitat in the Columbia Plateau has been greatly reduced from historical levels due to urban development, agricultural conversion, wildfires, and fragmentation. These changes place additional stressors on shrub-steppe obligate species and some, such as the Greater Sage Grouse (*Centrocercus urophasianus*), have been locally extirpated. Federal laws, including the Migratory Bird Treaty Act of 1918 (MBTA), provide protection for these species. Monitoring is essential to not only maintain current biological information on the abundance and distribution of these species on the Hanford Site, but also to ensure compliance with protection regulations and to inform future protection and management efforts.

Several sagebrush-steppe dependent species, such as the Sagebrush Sparrow (*Artemisiospiza nevadensis)*, Sage Thrasher (*Oreoscoptes montanus*), and Loggerhead Shrike (*Lanius ludovicianus*), are currently listed by the Washington State Department of Fish and Wildlife (WDFW) as "candidate species" and have the potential to be listed as threatened or endangered in the future (WDFW 2013). In addition, the Hanford Site and surrounding area provides refuge to potentially 17 state-listed species as well as numerous state-monitored species (WDFW 2017) that benefit from the large expanses of habitat. This list includes birds such as the Ferruginous Hawk, a state "threatened" species (WDFW 2013).

As resource managers of the Hanford Site, DOE-RL is responsible for the conservation of wildlife and wildlife habitats (DOE/RL 96-32). Avifauna have been documented and monitored on the Hanford site for over 60 years (WHC-EP-0402), including over 20 years of roadside survey monitoring on four historical survey routes, which were established by Pacific Northwest National Laboratory (PNNL) in 1988 (Figure 1). These routes were monitored in the spring months from 1988 through 1991, with winter counts being added in 1992 and 1993. Each transect was monitored monthly between 1994 and 2001 (Rickard Personal Communications). The monitoring performed in 2016 provides continued data for documenting species occurrence and distribution on the Hanford Site, and can be compared with the long-term data collected on the Hanford Site over multiple decades. The monitoring of birds that occur on the Hanford site is a valuable tool for developing baseline information on the presence and distribution of biological resources across the Hanford Site, identifying trends in species or populations, and compiling biological information necessary to implement adaptive management (DOE/RL 96-32).

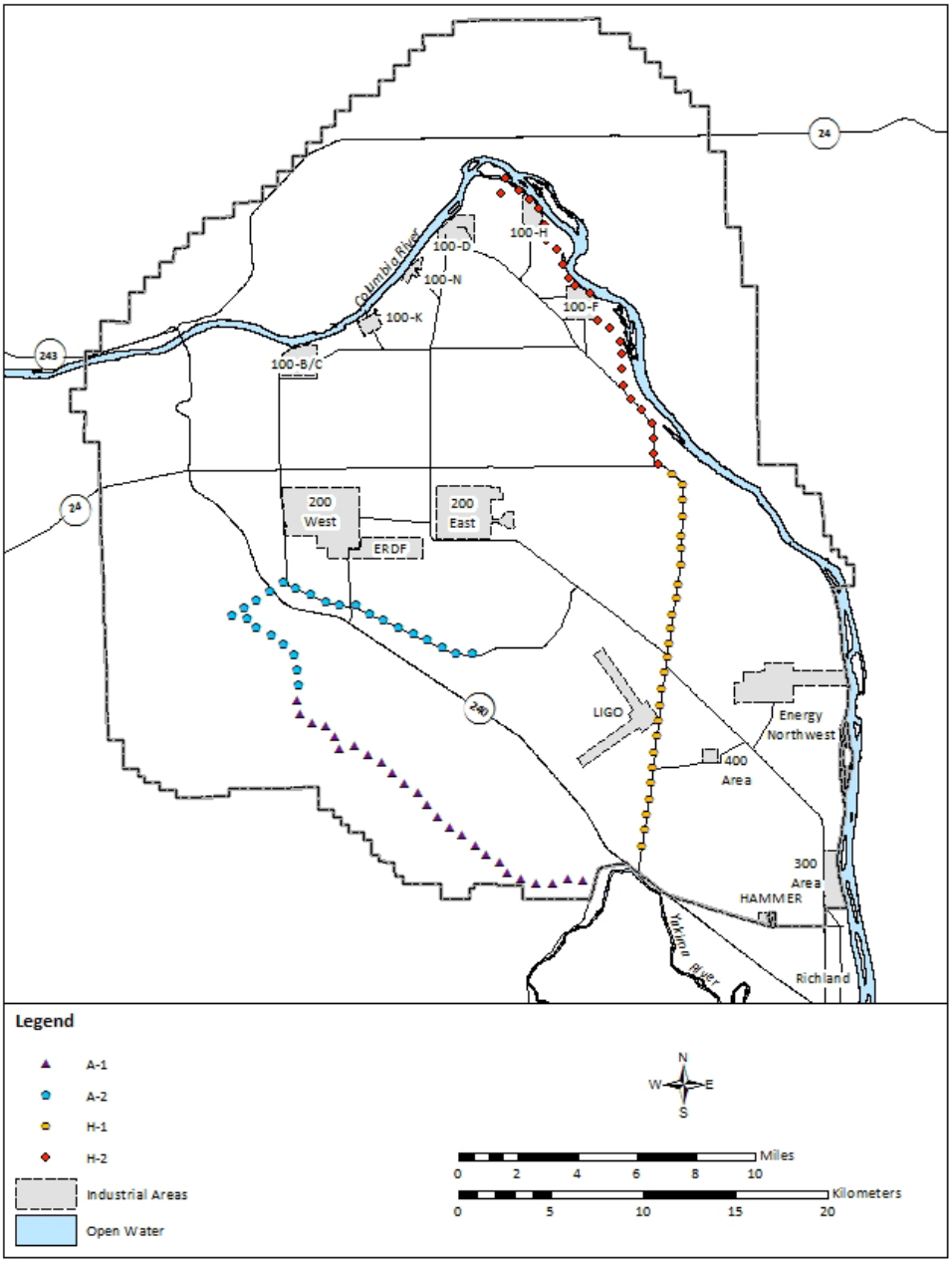

Figure 1. Roadside bird survey routes performed on the Hanford Site from 1988-2001

Bird Survey routes were modified in 2002 due to both the transfer of management responsibility of the Fitzner-Eberhardt Arid Lands Ecology Reserve (ALE) from the DOE to the U.S. Fish and Wildlife Service (USFWS), and a large fire in 2000, which modified the habitat along the routes. In 2002, surveys along ALE were discontinued as part of the DOE routine program, and a new route was established to monitor mature sagebrush communities on the north side of Gable Mountain and Gable Butte, previously burned areas, and successional grassland communities (Wilde et al. 2013). The four modified roadside bird survey routes that have been used from 2002 to present are shown in Figure 2.

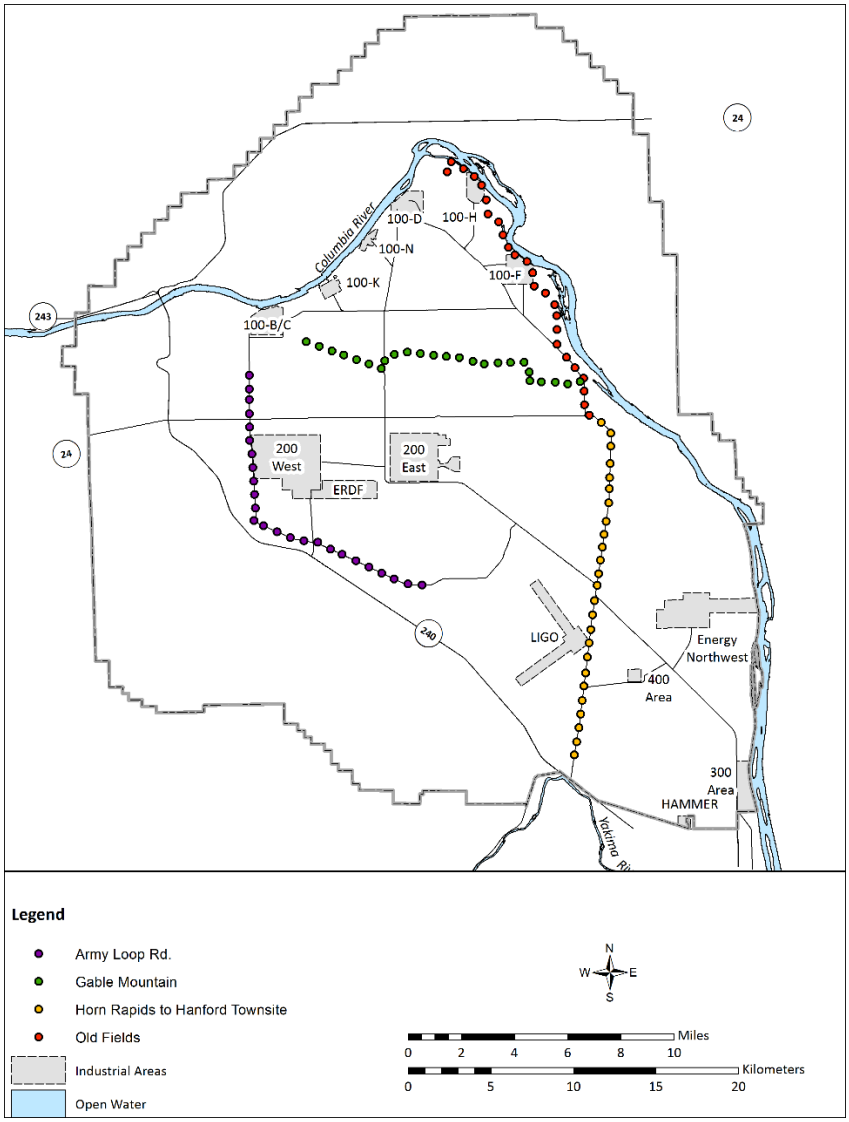

Figure 2. Roadside bird survey routes and point locations used on the Hanford Site since 2002

In 2005, Hanford became part of the North American Breeding Bird Surveys (BBS). The BBS is a unique collaborative counting effort designed to increase the understanding of North American bird populations and is now used as the primary data source for estimation of population change and modeling of the possible consequences of change in land use, climate, and many other possible stressors on bird populations (Sauer 2010). Jointly developed and coordinated by the United States Geological Survey (USGS), USFWS, and the Canadian Wildlife Service, the BBS incorporates counting efforts across the Unites States and Canada. Comprehensive summaries of population change have been calculated for >400 species of birds across North America (Sauer et al 2003). In 2005, two of the current routes, "Horn Rapids to Hanford Townsite" and "Old Fields", were surveyed in combination as the annual "Horn Rapids" BBS route. The "Richland" BBS route was created in 2006 from the previously discontinued ALE routes, including half of the current "Army Loop Rd" Route. Figure 3 shows the two USGS BBS survey routes performed at Hanford.

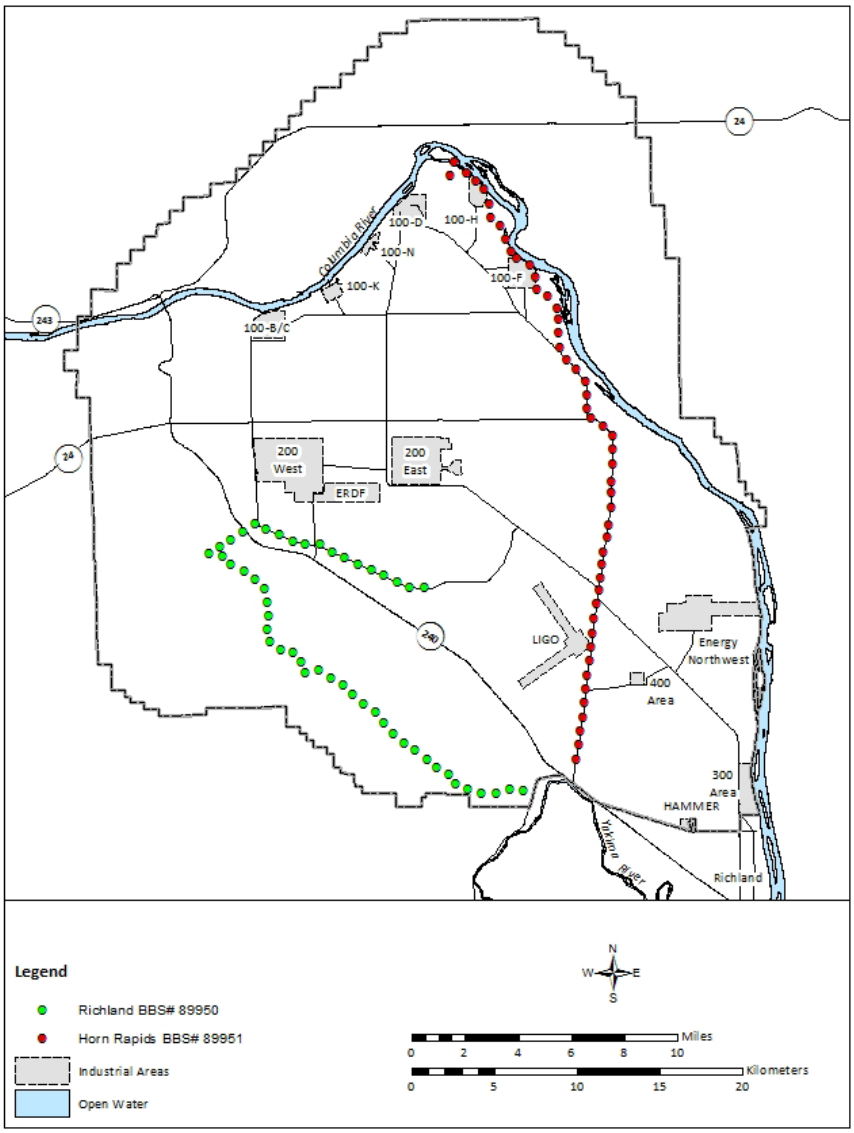

Figure 3. The U.S. Geological Survey Breeding Bird Survey routes performed annually on the Hanford Site

To maintain consistency and allow the official BBS data to fit within the annual program results, MSA follows the methods of the BBS described in Section 2.0 to perform counts along survey routes.

1.3 Objectives and Scope

Part of the Executive Order 13186 included directions to federal agencies to take actions in implementation of the MBTA and promote the conservation of migratory bird populations. Hanford coordinates with site contractors and outside agencies to help support data collection on avian species. In the 2016 season, bird surveys consisted of point counts in support of the Audubon Washington and the WDFW Sagebrush Songbird Survey (SSS) and annual roadside survey counts including the USGS BBS. The SSS project includes a multi-year (5-10 year minimum), program that surveys the Columbia Plateau to determine sagebrush songbird distribution across the region. Shrub-steppe communities across the state continue to be threatened by development and wildfires. Understanding the status and range of many shrub-steppe

obligate species can help guide conservation efforts of local, state and federal agencies. This report will focus on the data collected at the Hanford Site using these protocols, and not on the region-wide effort of the program. Cooperation with the SSS is part of the Hanford Site's ongoing efforts to work with outside agencies in developing datasets for avian communities around the state. Migratory bird and breeding bird roadside surveys were performed on four historical survey routes in 2016 (Figure 2). Road surveys are a practical way to monitor changes in species richness (number of species represented in the community) and relative abundance (how common or rare a species is relative to other species in the community) of shrub-steppe birds over time and in response to various types of land-use changes. Monitoring of avian populations on Hanford strengthens migratory bird conservation through data collaboration between DOE-RL and other agencies including federal, state, tribal and local governments.

This report does not provide an inventory of all birds that inhabited any portion of the Hanford Site in 2016, but rather documents the status of birds identified through a transect survey and the SSS point count method. The scope of this work is to document the numbers of birds using areas by documenting bird presence. The SSS surveys attempt to assign a sex, breeding code or potential breeding status to each location while roadside surveys focus solely on presence and number of individuals. All data collected during these activities are used by the Hanford Ecological Monitoring and Compliance program, the USGS BBS data are used by the USGS, and the SSS data are publicly available on eBird and used by the State Audubon and WDFW as well as any public entity wishing to use the information.

2.0 Methods

In 2016 the survey protocols included roadside survey counts and the SSS point counts. Roadside point counts and standalone point count survey protocols are widely used in avian monitoring programs across the country. These methods provide data from both large geographic areas (roadside surveys) and habitat-focused surveys away from roadside influence (Sagebrush Songbird Survey).

2.1 Roadside Survey Counts

Roadside survey counts follow the protocols used for the BBS coordinated by the USGS annually throughout North America (Bystrack 1981; Sauer 2010). Four survey routes (Figure 2) or portions of routes were surveyed a single time during the 2016 breeding season in coordination with BBS.

Hanford routine roadside routes are 20 kilometers (km) (12.43 mi) compared to the 40-km (24.85 mi) routes used in the BBS (Figure 2, Figure 3). The 40-km (24.85 mi) "Horn Rapids 89951" BBS route surveys both the "Horn Rapids-to-Hanford Townsite" [20-km (12.43 mi)] and "Old Fields" [20-km (12.43 mi)] Hanford survey routes. All roadside routes contain point counts at 0.8-km (0.5 mi) intervals marked with steel fence posts, rebar posts, pin flags, or by GPS coordinates only. There are 25 survey points per Hanford route and 50 survey points per BBS route. Birds within 400 meters (m) (0.25 mi) of each survey point were identified by sight or sound during a three-minute period at each marker post. Surveyors drove to each survey location and observed the area for three minutes, recording their observations. The number of vehicles passing by during the survey time was recorded on the field sheet for each point. Observers remained at a survey point for more than the three minutes only if additional time was needed to confirm identification or to count birds that were noted during the three-minute observation period. Observations of any nesting activities within 400-m of the survey point were also noted. When complete, staff will travel to the next point.

Hanford surveys begin in the early morning hours, starting no earlier than 30 minutes before sunrise and no later than 30 minutes following sunrise. The BBS survey routes were started as near as possible to 0438 hours, as required by the USGS for BBS surveys performed May 25th through July 7th. Surveys were halted if adverse weather conditions such as high winds, heavy rain, or snowfall developed during the route survey. Each route was surveyed once during pre-breeding, breeding, and fall survey periods.

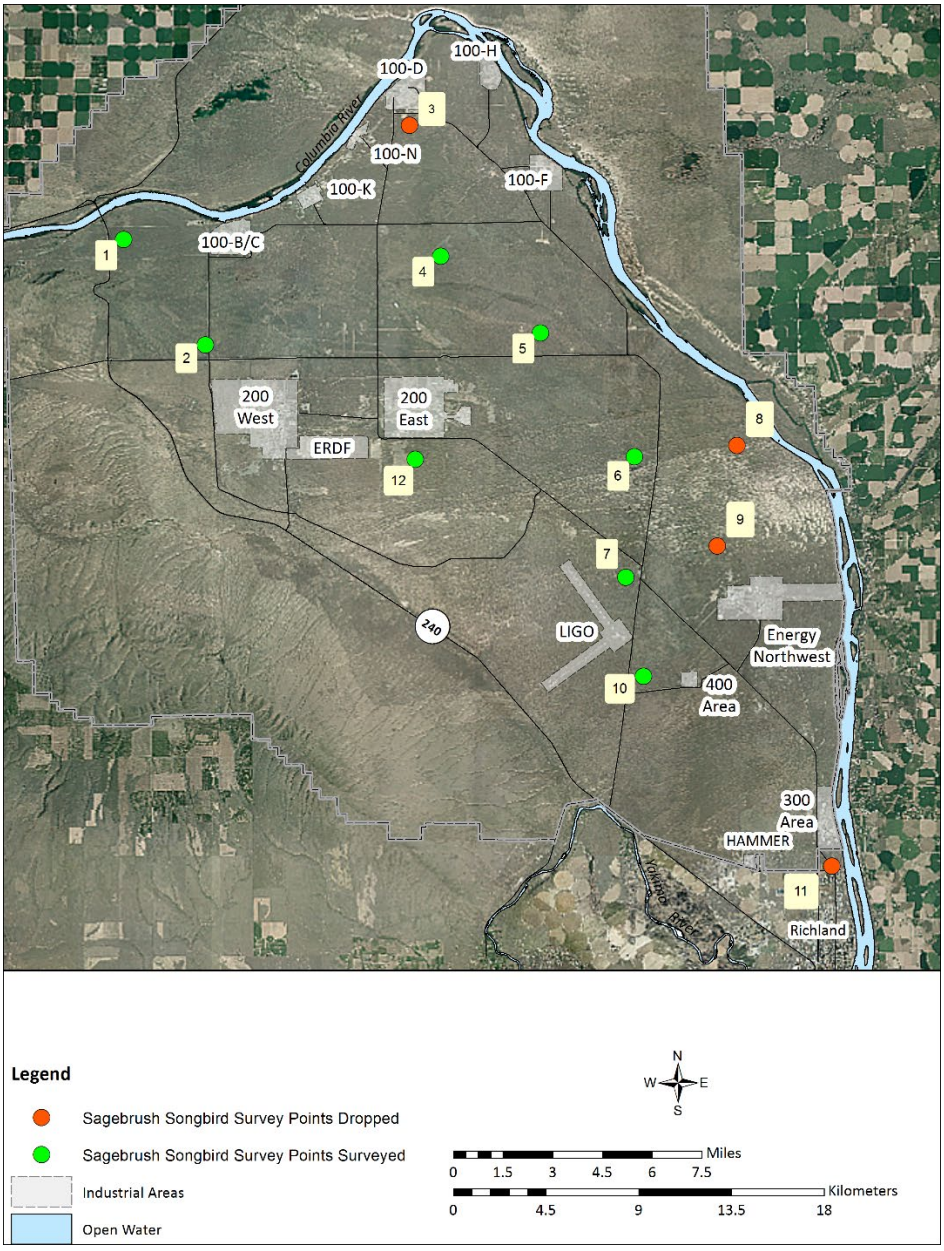

Figure 4. 2016 Sagebrush Songbird Survey Points

2.2 Sagebrush Songbird Survey

The methodology for performing the Sagebrush Songbird Survey counts were developed by the Audubon Washington and the WDFW. Suggested survey points are received from the Audubon Washington for verification. The sites are visited to determine that the point would provide value to the survey and confirmed, moved or dropped from the list (Figure 4). Sites were moved or dropped if there was poor habitat that would not produce valuable avian survey data (eg. expansive cheatgrass area) or if they were inaccessible due to fire danger and/or located in sensitive species buffers. Each of these points were surveyed once in each of the months of April, May and June. The surveys were performed between dawn to 0900 hours on days with no heavy rain and no substantial wind. Each point has three surveys performed for every visit; a traveling count from vehicle to point, a 10-minute point count following a 2-3 minute

settle period, and a traveling count from the point to the vehicle. Data are recorded and scanned and submitted to Audubon Washington at the end of the season. The focal species of the Sagebrush Songbird Survey protocol include the Sagebrush Sparrow and Sage Thrasher.

2.2.1 Data Collected During Traveling Counts

- Record the distance walked from the parking spot to the survey point
- Record time when starting walk to (or from) survey point (Time start)
- Note birds while walking from parking area to survey point and on return trip
- Note ONLY individuals that can be positively identified to species
- If a singing male, enter yes for Singing; Tally similar observations in column Tally
- Record time when arrived at destination (Time end)

2.2.2 Data Collected During Point Counts

- When arriving at the survey point take 2-3 minutes to let things settle and count sagebrush (2.2.3)
- Record the time started looking and listening for birds (start of 10-minute survey)
- Remain at the point and note ONLY individuals that can positively identified to species
- Do not use recorded vocalizations to illicit response or attract birds
- STOP recording birds at the 10-minute mark

2.2.3 Data Collected During Sagebrush Counts

- Count the number of sagebrush plants within about 100 yards of the survey point.
- **Do not include rabbitbrush or other shrubs**
- Include only sagebrush that are at least 0.5 meters in height (about knee-height)
- Circle this value in on the bottom of page 1 of the form (for example: “1-10”)

2.3 Measuring Species Diversity

There is a wide range of indices for evaluating species diversity. Species diversity is a measure of species richness and species evenness and provides insight into the makeup of a community. An extreme example to the value of diversity indexes would be to look at two communities, each with 5 species and 100 total individuals. Community A contains 96 of species 1 and only a single individual of the other 4 species; community B contains 20 individuals each of five species. The question becomes which community is more diverse? If the researchers belief is that both communities are equally diverse, then species richness suffices as the only needed indices. If the belief of the researchers are that the communities are vastly different in diversity due to the imbalance of individuals, then species diversity indexes provide additional insight (USFWS 1999).

The most widely used diversity index is referred to as Shannon’s index. Shannon’s index reflects both species richness and evenness of distribution among species present. An equation for the Shannon index, using natural logarithms (ln) is:

$$H' = \sum_{i=1}^{i=S} (p_i)(\ln p), i = 1,2, \dots S$$

Where S = number of species in the sample, and p is the proportion of all individuals belonging to the species. Additionally for this report we transform H' with natural logarithms, given by $e^{h'}$, and is labeled as N_1. This transformation expresses the diversity in terms of species instead of the original base 2 term of bits. When species diversity is close to species richness the communities are considered to have an evenness. That is the species distribution is maximally even when $S = N_1$. More information on Shannon's index and reasoning for its use in avian monitoring programs, can be found in the *Statistical Guide to Data Analysis of Avian Monitoring Programs* (USFWS 1999).

3.0 Results

3.1 Roadside Bird Surveys

All surveys were completed successfully during the breeding season and resulted in data collection for four Hanford route surveys (Table 1). The "Horn Rapids" BBS route includes both the "Horn Rapids–to-Townsite" and "Old Fields" routes in a single run. The second half of the "Army Loop Rd" route (points 12-25) were surveyed in 2016 as part of the "Richland" BBS route completion, points 1-11 were completed following the completion of the "Richland" BBS route. The breeding season is the most consistently surveyed period throughout the years, and the best data sets used for trending. For the 2016 breeding season surveys, a total of 1219 individual birds were documented (Table 2), similar to the 1227 individuals counted during breeding period surveys in 2015 and 1332 individuals from same period in 2014. Fifty bird species were documented in the 2016 breeding season survey (Table 3), which was nearly identical to the 51 species seen in breeding period surveys during 2015 and 2014.

Table 1. 2016 Survey dates and location.

Route Name	Breeding Survey Date
Army Loop Rd	06/23/2016[a]
Gable Mountain	06/06/2016
Horn Rapids to Hanford Townsite	06/07/2016 [b]
Old Fields	06/07/2016[b]

[a] Surveyed during Richland BBS
[b] Surveyed during Horn Rapids BBS

The Western Meadowlark (*Sturnella neglecta*) was the most abundant species documented. Surveys documented 218 Western Meadowlark individuals, 17.88% of all individuals counted. The second most abundant species was the Horned Lark (*Eremophila alpestris*) with 210 individuals, 17.22% of surveyed individuals (Table 2). The Western Meadowlark was counted on 82 survey points (82.00 %), while the Horned Lark was documented on 77 survey points (77.00%). These two species were clearly the most documented species in 2016; they were counted at nearly three times as many survey points as any other species documented, including the Common Raven (*Corvus corax*), which was documented on 25 points.

During the breeding season the "Old Fields" route had the highest species diversity and the highest abundance of individuals (Table 3). The "Old Fields" route has historically been the route with the highest species richness and abundance. The route runs along the northeastern edge of the central Hanford Site, often directly adjacent to the Columbia River, providing the largest variety of habitat of any route.

Table 2. Species, Sorted by Abundance, During Breeding Season Roadside Surveys Performed on the Central Hanford Site in 2016.

Common Name	Scientific Name	Routes[a]	Individuals	% Counts	Stops[b]	% Stops
Western Meadowlark	*Sturnella neglecta*	4	218	17.88	82	82
Horned Lark	*Eremophila alpestris*	4	210	17.23	77	77
Cliff Swallow	*Petrochelidon pyrrhonota*	2	203	16.65	12	12
Common Raven	*Corvus corax*	4	67	5.5	25	25
Red-winged Blackbird	*Agelaius phoeniceus*	2	49	4.02	11	11
European Starling	*Sturnus vulgaris*	1	45	3.69	7	7
Canada Goose	*Branta canadensis*	1	42	3.45	3	3
Lark Sparrow	*Chondestes grammacus*	4	35	2.87	23	23
Common Nighthawk	*Chordeiles minor*	3	34	2.79	12	12
California Quail	*Callipepla californica*	3	29	2.38	10	10
Sagebrush Sparrow	*Artemisiospiza nevadensis*	3	29	2.38	13	13
Great Egret	*Ardea alba*	1	28	2.3	4	4
Brewer's Blackbird	*Euphagus cyanocephalus*	1	21	1.72	6	6
Black-billed Magpie	*Pica hudsonia*	3	19	1.56	7	7
House Finch	*Haemorhous mexicanus*	3	16	1.31	6	6
Double-crested Cormorant	*Phalacrocorax auritus*	1	14	1.15	2	2
Great Blue Heron	*Ardea herodias*	1	14	1.15	2	2
Loggerhead Shrike	*Lanius ludovicianus*	3	13	1.07	13	13
Western Kingbird	*Tyrannus verticalis*	3	13	1.07	7	7
Ring-billed Gull	*Larus delawarensis*	1	12	0.98	5	5
Bank Swallow	*Riparia riparia*	1	11	0.9	3	3
American White Pelican	*Pelecanus erythrorhynchos*	2	10	0.82	2	2
Bullock's Oriole	*Icterus bullockii*	1	10	0.82	4	4
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	1	10	0.82	3	3
Long-billed Curlew	*Numenius americanus*	1	7	0.57	5	5
Rock Wren	*Salpinctes obsoletus*	2	7	0.57	4	4
Mourning Dove	*Zenaida macroura*	2	6	0.49	3	3
American Robin	*Turdus migratorius*	1	5	0.41	2	2
Eastern Kingbird	*Tyrannus tyrannus*	1	5	0.41	3	3
Mallard	*Anas platyrhynchos*	1	5	0.41	3	3
Common Merganser	*Mergus merganser*	1	3	0.25	1	1
Osprey	*Pandion haliaetus*	2	3	0.25	2	2
Swainson's Hawk	*Buteo swainsoni*	1	3	0.25	3	3
Bald Eagle	*Haliaeetus leucocephalus*	1	2	0.16	1	1
Belted Kingfisher	*Megaceryle alcyon*	2	2	0.16	2	2
Killdeer	*Charadrius vociferus*	1	2	0.16	1	1
Red-tailed Hawk	*Buteo jamaicensis*	1	2	0.16	2	2
Savannah Sparrow	*Passerculus sandwichensis*	2	2	0.16	1	1
Sage Thrasher	*Oreoscoptes montanus*	1	2	0.16	2	2

American Kestrel	*Falco sparverius*	1	1	0.08	1	1
Barn Swallow	*Hirundo rustica*	1	1	0.08	1	1
Gadwall	*Anas strepera*	1	1	0.08	1	1
Northern Harrier	*Circus cyaneus*	1	1	0.08	1	1
Ring-necked Pheasant	*Phasianus colchicus*	1	1	0.08	1	1
Say's Phoebe	*Sayornis saya*	1	1	0.08	1	1
Tree Swallow	*Tachycineta bicolor*	1	1	0.08	1	1
Northern Mockingbird	*Mimus polyglottos*	1	1	0.08	1	1
Spotted Sandpiper	*Actitis macularius*	1	1	0.08	1	1
Violet-green Swallow	*Tachycineta thalassina*	1	1	0.08	1	1
Prairie Falcon	*Falco mexicanus*	1	1	0.08	1	1

[a] Count of how many of the 4 unique Hanford Roadside routes was species identified (4 Max)
[b] Number of survey points the species was identified

Table 3. Species Richness and Abundance Counted During the 2016 Breeding Season Roadside Bird Survey Routes on the Hanford Site Sorted by Route.

Route Name	Surveys Performed	Species Richness	Abundance
Army Loop Road	1	16	103
Gable Mountain	1	13	207
Horn Rapids to Hanford Townsite	1	13	223
Old Fields	1	42	686
Total	**4**	**50** [a]	**1219**

[a]Number of unique species identified

3.2 Sagebrush Songbird Survey

A total of 8 survey sites were visited in each month during April, May and June. The data presented here are from the 10-minute point count survey portion of the protocol. Table 4 presents the richness and abundance of the points surveyed. Points 3, 8, 9, and 11 were not surveyed due to lack of shrubs or native grasses that would be considered a suitable habitat.

Table 4. Species Richness and Abundance Counted at the 2016 Sagebrush Songbird Survey Points

Hanford Point	Surveys Performed	Species Richness	Abundance
1	3	9	46
2	3	8	77
4	3	6	71
5	3	8	90
6	3	6	55
7	3	5	73
10	3	8	59
12	2	3	20
Total	**23**	**17** [a]	**491**

[a] Number of unique species identified

The focal species of the Sagebrush Songbird Survey protocol included the Sagebrush Sparrow and Sage Thrasher. A total of 68 Sagebrush Sparrows were documented over the 23 surveys. Over 85 percent of the Sagebrush Sparrows were documented on three of the eight survey points (2, 4, 5), and no Sagebrush Sparrows were seen on point 6, 7 or 12. Sagebrush Sparrows were documented on 11 of the 23 surveys performed. A total of 5 Sage Thrashers were documented at three sites on three separate dates in 2016.

The roadside surveys identified the most prevalent species to be Western Meadowlark (n=146) and the Horned Lark (n=145) with the Sagebrush Sparrow (n=68) being the third most identified species during surveys. A total of 17 unique species and 491 individuals were identified (Table 4). Point count location 1 had the highest species richness (n=9) and location 5 had the highest number of individuals (n=90) while point 12 had both the lowest numbers of individuals (n=20) and the lowest species richness (n=3) of all eight points surveyed.

3.3 Diversity Index

Surveys from the breeding season during the last 5 years were compiled and the average number of individuals, total number of species seen and Shannon's Diversity index calculations were determined (Table 5).

Table 5. Five Year Cumulative Data and Shannon's Diversity Index and Evenness on the Four Hanford Routes (2012-2016)

Route Name	Average Number Individuals	Cumulative Species Richness	Ecological Species Diversity[a]	Evenness = E
Army Loop Road	133.6	29	4.97	0.498
Gable Mountain	188.4	26	7.90	0.634
Horn Rapids to Hanford Townsite	245.8	27	5.70	0.534
Old Fields	674.0	64	18.40	0.706
Average	310.45	36.50	9.24	0.593
Cumulative	1241.8	74	17.1	0.664

[a]Shannons index expressed as N_1

Table 6. 2016 Survey Data Compared to the Five Year Cumulative Data and Shannon's Diversity Index and Evenness on the Four Hanford Routes (2012-2016)

Route Name	5 year Average	2016 Counts (+/- to Average)	5 Year Ecological Species Diversity[a]	2016 Ecological Species Diversity[a]	5 Year Evenness	2016 Evenness
Army Loop Road	133.6	103 (-30.6)	4.97	6.04	0.498	0.648
Gable Mountain	188.4	207 (+18.6)	7.9	6.92	0.634	0.754
Horn Rapids to Townsite	245.8	223 (-22.8)	5.7	5.42	0.534	0.659
Old Fields	674	686 (+12)	18.4	16.72	0.706	0.754
Average	310.45	304.75 (-5.7)	9.24	8.78	0.593	0.704
Cumulative	1241.8	1219 (-22.8)	17.1	16.85	0.664	0.722

[a]Shannon's index expressed as N_1

4.0 Discussion

For over 25 years, the roadside bird survey monitoring program has provided the Hanford Site with valuable avian community data needed for population and habitat evaluation. As designed, the surveys are intended to be an indicator of abundance, species distribution, and potential habitat quality. Performing surveys using BBS methods is an efficient way of collecting species data over large portions of the Hanford Site and provide data that are comparable with the historical data set. All Hanford BBS route data are also displayed on the USGS BBS database for download and viewing. It is acknowledged that a roadside monitoring program is not without bias; however, the benefits are considered to outweigh most disadvantages (USDA 1993). The Sagebrush Songbird data captured within this report and the other statewide Sagebrush Songbird data is housed in eBird and is being used to validate the Western Governors

Association Crucial Habitat Assessment Tool distribution models and update the WDFW Habitat Species database.

The species and number of individuals documented was similar to past years with dominant Western Meadowlark and Horned Lark counts. Species richness on the "Old Fields" route (n=42) was the highest of all routes. This result is to be expected as the largest diversity of species-rich habitats occurs along the route near the Columbia River. However, Tables 5 and 6 show the diversity index of this route, while still higher than other routes, dropped significantly over the last 5 years. One possible explanation is that although a high number of species is observed, many of the sightings are of a single individual or small number of individuals, while the more common birds of the route maintain high count numbers. All survey routes have a much lower diversity index than species richness number. If the identical number of individuals is counted for all species than the diversity index should be equal to the species richness. This skew is explained by the high number of Western Meadowlarks and Horned Larks that are counted during surveys and the large communities of Cliff Swallows seen on reactor structures along the river. These three species accounted for 51.76% of all individuals. Over half of the individuals counted are limited to just 6% of species, generating the low diversity index numbers exhibited in Tables 5 and 6. Over the past five years (Table 5), the "Gable Mountain" route had a higher diversity index and higher evenness than "Army Loop Road" and "Horn Rapids-to-Townsite" even though it has a lower species richness. Much of this route passes through high quality shrub habitat on the north side of Gable Mountain. While the number of species is lower, there are less areas for Western Meadowlark and Horned Lark to dominate the survey numbers and species like Loggerhead Shrike and Sagebrush Sparrows are more prevalent leading to more evenness in individuals across species. These data reveal the value of the remaining high-quality habitats on the Hanford Site to the avian community and provide justification for the conservation of these areas.

Three species of birds; Sagebrush Sparrow, Loggerhead Shrike and Long-billed Curlew (*Numenius americanus*) are common breeders on the Hanford Site and trends are examined here. These species were selected for analysis based on their status as a listed Washington State Species of Concern by the WDFW and are readily detectable during roadside surveys through associated habitats. These data are plotted on a log-number observed scale to determine the population trend over the past 5 years during the breeding season (Figure 5, 6 and 7). A log-based y-axis was used to reduce the variation and provide a better fit for the trend line and R^2 value to the data over such a short temporal scale. By solely using R^2 from trend lines in these plots, a statement may be made that ~58% variation in Sagebrush Sparrows is accounted for by an exponential increase numbers with increasing year. Low R^2 in the Loggerhead Shrike (~36%) and very low (~2%) for Long-billed Curlew suggest that the variation in numbers in not related to an increase in year but rather some additional unmeasured variable. The Sagebrush Sparrow's increasing in numbers on the Hanford Site is a positive sign due to the protection of habitat on Hanford, or possibly due to an increased stress on shrub habitat outside of Hanford due to wildfires and agriculture.

Bird surveys should continue on Hanford to document species diversity, population trending and other environmental changes in the area. Hanford should continue to protect remaining shrub habitats and continue with quality restoration and revegetation projects across the site to increase the amount of shrub habitat. These data suggest that quality shrub habitats produce a more diverse and even population in the avian communities that inhabit these areas. Measuring effectiveness of habitat conservation, restoration or mitigation through bird surveys can be an efficient method. During the breeding season, birds are often vocal and in view as to attract mates, which makes documenting individuals consistent and with a high degree of accuracy. This documentation can be utilized for evaluations of diversity and populations trends over time as shown in this report. The Hanford Site continues to be an excellent reserve for avian species and their continued success.

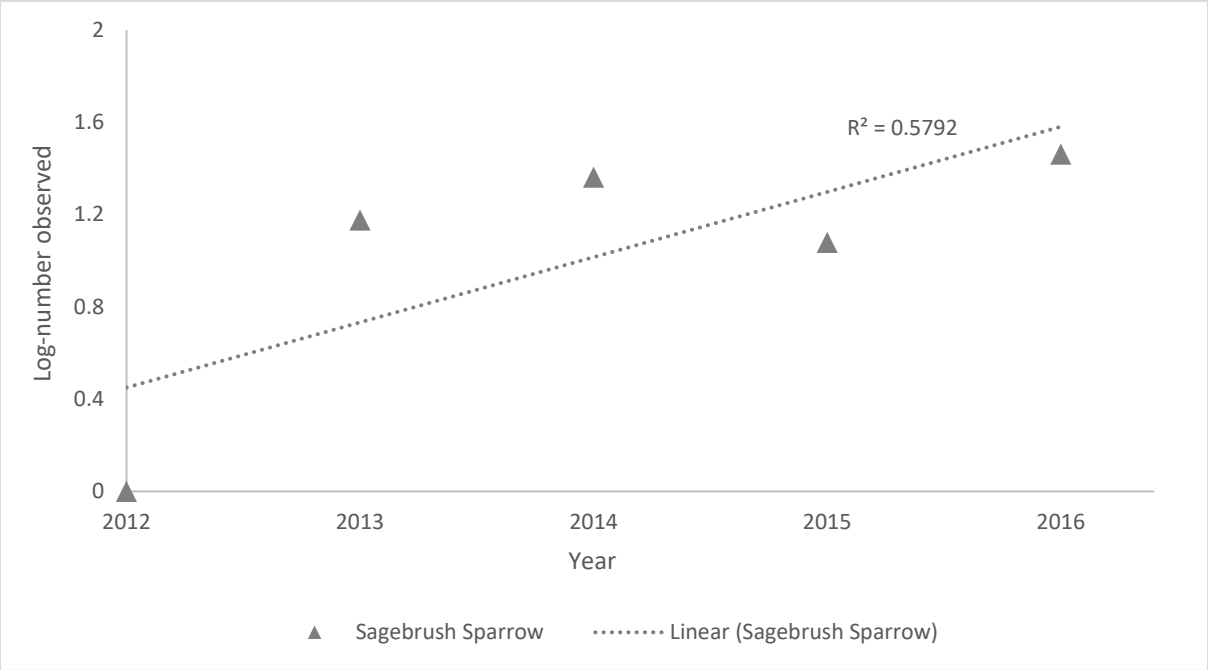

Figure 5. Trend, log-linear for Sagebrush Sparrow on the Hanford Site, 2012-2016

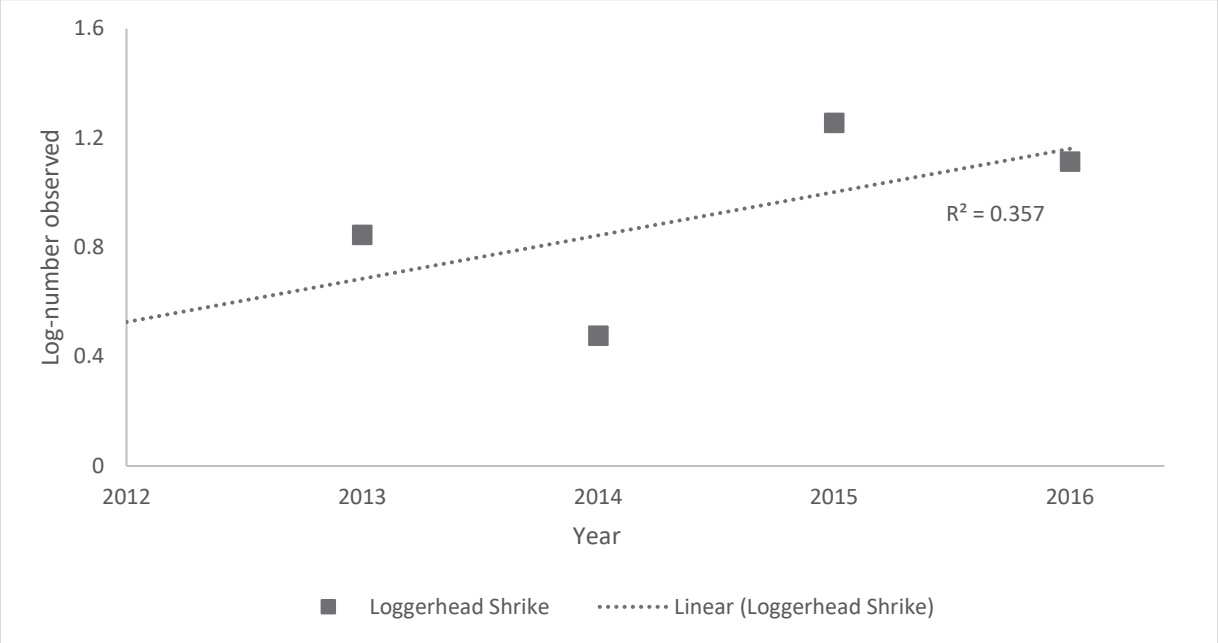

Figure 6. Trend, log-linear for Loggerhead Shrike on the Hanford Site, 2012-2016

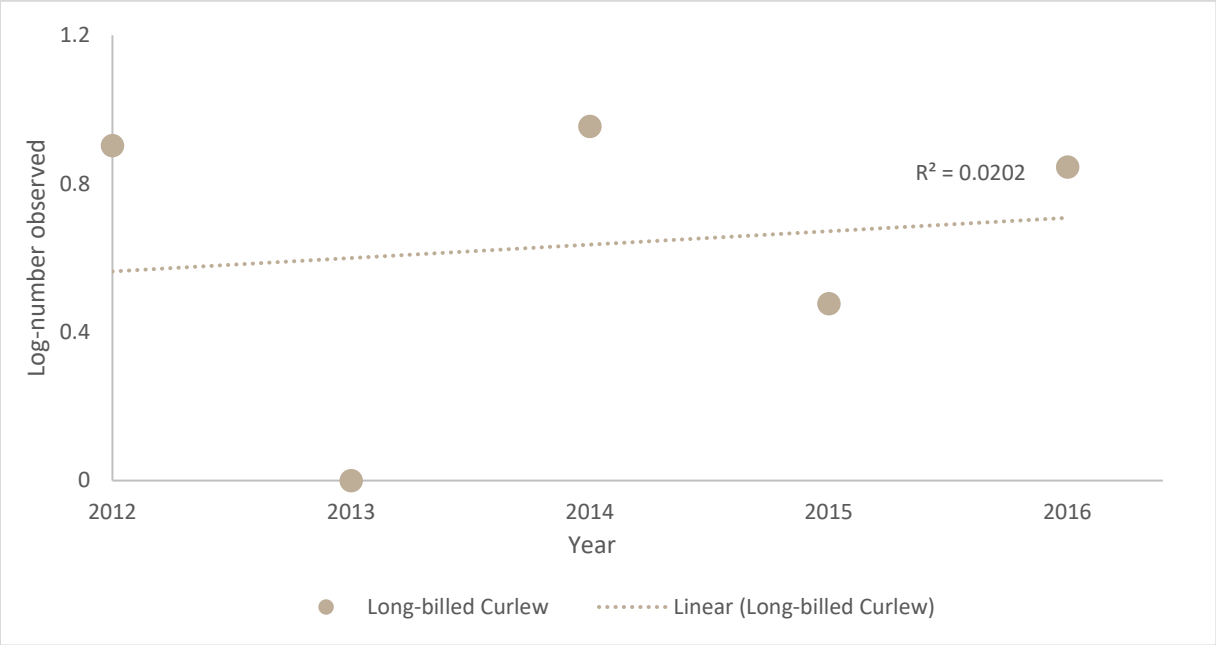

Figure 7. Trend, log-linear for Long-Billed Curlew on the Hanford Site, 2012-2016

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