2012 Sage Sparrow Surveys and Breeding Season Point Counts
Boardman Conservation Area
Boardman, Oregon

(Photo from Moore 2006)

Prepared by
Catherine Engelman
Avian Ecologist
The Nature Conservancy- Oregon Chapter
cengelman@tnc.org

Table of Contents

Table of Contents (cont.)

List of Tables and Figures

Introduction

Sage sparrows, (*Amphispiza belli*), are one of several species chosen as conservation targets under a Multi-Species Candidate Conservation Agreement with Assurances (MSCCAA) covering the Boardman Conservation Area (BCA). The MSCCAA was prepared through a collaborative effort in 2003 among The Nature Conservancy (TNC), the U.S. Fish and Wildlife Service, Threemile Canyon Farms, Portland General Electric, and the Oregon Department of Fish and Wildlife (DEA 2004). In 2001, prior to the MSCCAA, TNC entered into a lease agreement with Threemile Canyon Farms, (a subsidiary of Boeing Agricultural Industrial Company), to manage the BCA. Threemile Canyon Farms originally established the BCA in compliance with a litigation settlement over proposed water withdrawals from the Columbia River. This resulted in the conservation of one of the largest remaining patches of native grasslands and shrubsteppe in the Columbia Basin Ecoregion (Nelson 2003). The MSCCAA was developed in support of TNC's management goal for the property, which is to "protect, maintain, and restore the native bunchgrass and shrub-steppe ecosystems and their associated at-risk species" (Nelson 2007).

The sage sparrow was chosen as a target species to indicate health of the shrubsteppe community because it is a sagebrush obligate that has shown declines both in population and distribution (Peterjohn and Sauer 1999, Knick and Rotenberry 2002). The sage sparrow was an appropriate choice as an indicator species because they are extremely sensitive to multi-scale habitat alterations, and population declines may indicate imminent collapse of shrubsteppe ecosystems (Rotenberry and Knick 1999, Knick and Rotenberry 2000, Knick et al. 2003). A monitoring program for sage sparrows on the BCA began in 2003, and was repeated every three years. This report describes the results of the fourth tri-annual sage sparrow surveys conducted on the BCA. This report also describes the creation of a species list, raptor nest locations, and bird point count surveys for the BCA in 2012.

Study Area

The 22,642 acre BCA is located southwest of Boardman, Oregon in Morrow County (Figure 1). The BCA is bordered on the east by the U.S. Naval Weapons Systems Training

Facility at Boardman (NWSTF). The Portland General Electric (PGE) Boardman Coal Plant operates on a property surrounded by the inner western corner of the BCA. The north-south border between PGE and the BCA follows Carty Reservoir, a 1,154 acre reservoir which was initially created by Portland General Electric for storage of cooling water. The remaining landscape surrounding the BCA is dominated by agriculture (Nelson 2003).

The BCA is part of the Umatilla Basin or Umatilla Plateau which is the Oregon section of the Columbia Basin Ecoregion (Kagan et al. 2000) . The BCA along with the contiguous NWSTF comprise the largest remaining patch of undeveloped habitat in the Umatilla Basin (Nelson 2003). Historically, the Umatilla Basin contained a vast expanse of continuous sagebrush habitat which supported substantial populations of shrubsteppe birds (Gabrielson and Jewett 1940). Currently within the Umatilla Basin over 85% of sagebrush steppe has been lost, primarily through conversion to agriculture (Kagan et al. 2000). The BCA and NWSTF contain the best remnants of sagebrush ecosystems in the Columbia Basin (Kagan et al. 2000), and also support the only remaining breeding populations of sage sparrows within Morrow county (Humple and Holmes 2001).

Since the sage sparrow monitoring program began in 2003, there have been several major changes to the landscape within and around the BCA, including changes in grazing, a large wildfire, and the development of wind farms within the Umatilla Plateau.

In the late spring of 2005 grazing was discontinued on the BCA. Six years post-grazing Elseroad (2011) found decreases in native annual forbs and species richness, and found that cheatgrass (*Bromus tectorum*) had increased. However, Elseroad (2011) noted that it was uncertain whether the increase in cheatgrass was due to the removal of grazing or other climatic conditions.

Approximately 14,000 acres of the BCA burned in a wildfire in the summer of 2008. This fire burned over a third, (~2,489 of 6,139 acres), of the sagebrush habitat on the BCA (Figure 2). In the three years following the fire, shrub frequency decreased on the BCA, and the frequency of cheatgrass increased (Elseroad 2011).

In the past 6 years there has been a rapid increase in wind energy projects in the Columbia Basin. In Morrow County the Willow Creek wind farm, the Three Mile Canyon wind farm, and Echo Windfarms all became operational in 2009 (RNP, accessed 2012). Windfarms have clearly changed the landscape matrix surrounding the BCA as they are now visible from nearly all locations on the BCA. However, it is unknown what effect the windfarms may have on the BCA.

For a more complete description of the BCA please refer to Nelson (2003) and Elseroad (2002).

Personnel and Equipment

Previous surveys were conducted by Morgan Omdal in 2003 (Omdal 2003), Randall Moore in 2006 (Moore 2006), and by James Brennan, Jasmine Graves, Melissa Reynolds, and Teresa Wicks, under the supervision of Douglas Robinson in 2009 (Robinson 2009). In 2012 the surveys were primarily conducted by myself, Catherine Engelman (CAE), but were occasionally assisted by Maile Uchida (MU), Jennie Russell (JR), and Mary Meier (MM). Leslie Nelson assisted in all years with project oversight and vegetation identification. Field data was collected using a Trimble Juno SB GPS with ArcPad 10, and a Bushnell Legend 1200 ARC Rangefinder.

Methods

Species List

A record of all birds detected on the BCA, or adjacent to the BCA, (primarily on Carty Reservoir), was kept throughout the season. The list includes birds detected on the standardized surveys, as well as incidental observations.

Raptor Nests

Locations of raptor nests were documented incidentally throughout the season. All large junipers encountered while conducting sage sparrow area searches were examined for evidence of nesting activity by raptors. If raptors were present the tree was viewed from a distance with

binoculars, and the tree's location was collected by using the GPS units' offset point option. Distance and bearing to the tree with were measured with a rangefinder and compass. If a nest was present in a tree, but no raptors were present the tree and nest were examined for evidence of recent nesting activity. Nests were identified primarily by the presence of adults or nestlings, but several recently failed or fledged nests were identified by feathers, whitewash, pellets, nest type, or any other evidence of recent reproduction which could be used to identify the species.

Point Counts

Vegetation Assessment

Omdal (2003) used the plant community classification system devised by Elseroad (2002) to classify the vegetation type and ecological condition within each 50m radius point count station. For more details about the methodology used to select points and classify vegetation refer to Omdal (2003) and Elseroad (2002). Each station was revisited in 2012, and the community type and condition was verified or updated using the same methodology. A map of the point count stations is shown in Figure 3.

Bird Surveys

Point counts were conducted at 61 roadside stations following the protocol described by Ralph et al. (1993). Each station was surveyed twice. The first round of surveys was started during the last week of April and was conducted from April 30-May 9. The second round of surveys was started during the last week of May and was conducted from May 31-June 8. Surveys were primarily conducted for the four hours following sunrise, and were not conducted past 10:00 am. Bird detections were recorded for an unlimited distance, but were classified as within a 50m-radius circle, outside a 50m-radius circle, and flyovers. Each point was surveyed for five minutes, and detections occurring within the first three minutes were recorded separately from detections occurring during the final two minutes of the survey.

Sage Sparrow Surveys

The goal of the sage sparrows surveys on the BCA was to 1) inventory all sagebrush habitat on the BCA to locate all the habitat on the BCA utilized by breeding sage sparrows; 2)

determine the number of breeding sage sparrow territories in areas on the BCA where breeding sage sparrows are present; and 3) determine how many sage sparrow territories on the BCA successfully produce fledglings.

Inventory

Omdal (2003), Moore (2006), and Robinson (2009) each stated that all sagebrush habitat on the BCA was searched. However, there is > 6,000 acres of sagebrush habitat on the BCA, which takes a substantial effort to search exhaustively. In all previous survey years no method was utilized to delineate and track the areas covered or to track survey effort in each area, with the result being that each survey is incomparable to each other. In 2012 I created a system to correct this oversight and to increase the accountability of the sage sparrow monitoring program. This standardized method should also make it possible to compare results between survey years.

Site Selection A 500 meter grid overlay was created for the entire BCA in ArcMap. Using the vegetation layer developed by Elseroad (2002), all grid sections that contained a vegetation community dominated by sagebrush were selected to be surveyed (Figure 4). This resulted in 247 plots ranging from .004 to 25 hectares. Site visits determined that 58 of the plots were not suitable due to small size or lack of sagebrush. Fifteen additional plots were determined to be unsuitable after they were surveyed. A further 42 plots were not surveyed due to time constraints. The 42 unsurveyed plots were skinny strips of sagebrush located in ravines, and had an extremely low probability of containing sage sparrows.

Area Searches Area searches were conducted on 147 plots between April 10 and July 11 in 2012. Each plot was systematically searched for sage sparrows. Only the areas of each plot containing sagebrush was covered. The GPS unit's tracklog was used to assure even coverage of each plot. For each survey the plot number, date, start time were recorded. The total time spent completing the survey, and all species detected on the plot were also recorded. Surveys took between 8 and 202 minutes to complete. If a new sage sparrow was detected during a survey the survey was paused and the bird followed for ~ 20-30 minutes, then the survey was resumed. Playback surveys were utilized 0-3 times within each plot in locations selected based on the observers best judgment. Playback surveys were conducted by broadcasting a recording of a sage sparrow song, then listening for a response for 1-2 minutes following the recording. In addition

to the area search plots, the area containing the territories from 2009 in Schoolhouse pasture was surveyed nine times over the course of the season.

Territory Mapping

Omdal (2003) and Moore (2006) tracked individual sage sparrows for as long as possible on each visit. Areas containing sage sparrows were revisited at least once a week. Territories were considered confirmed if territorial birds could be followed for over 20 minutes on three visits. Robinson (2009) used a combination of the flush mapping (Reed 1985) and Targeted Species Sampling Protocol (TASP) described in Humple and Holmes (2001) to locate and delineate territories. Territories were then revisited weekly. In all three years, bird locations were mapped by taking a single point directly at each shrub where a bird was located. Data linking bird movements or counter-singing were not recorded in a standard way on the BCA in any of these years.

In 2012, I improved the methodology by adapting the spotmapping protocol used in the SageSTEP project, (Leu unpublished data), to the needs of the BCA sage sparrow monitoring program. I partially retained the methodology from 2003 and 2006 in that the areas in which sage sparrows were detected were revisited at least once a week, and each territory was monitored at least once a week. Individual birds were tracked for at least 20 minutes if possible, and a territory was considered confirmed if birds could be followed for at least 20 minutes on three separate occasions (Omdal 2003, Moore 2006).

In 2012, rather than flushing the birds from their perch sites, the observer primarily followed birds from a distance, and perch sites were recorded using the offset point option on the GPS unit. Distance and bearing to the bird were measured with a rangefinder and compass, or were estimated if the bird could not be seen. This methodology was chosen because it allowed the observer a greater ability to watch the bird's activity without disturbing the bird, and increased chances of observing reproductive behavior. Movements of an individual bird were linked to each other, allowing a record of the bird's movements to be shown in ArcMap. Counter-singing between males was recorded. The majority of counter-singing events were recorded at least one time for each pair of males on each visit. Detections of multiple birds,

either of pairs or of birds of unknown relationships, were also recorded. For each bird detection, a detection type code was recorded which shows whether the detection was visual, a song, a call, some other type of detection, or a combination of detection types. It was assumed that all detections that were not visual were an estimated location rather than an exact location.

Counter-singing events were the primary data used to separate territories from each other. The exact shapes of territories were drawn using the visual observations whenever possible. The birds were not color banded, so in many instances assignment of points to a territory was difficult. An example of data typically collected in 1-3 spotmapping sessions can be seen in Figure 5. After every few spotmapping sessions the territory shapefiles were updated and loaded onto the GPS unit to aid with subsequent spotmapping.

Reproductive Success

Sage sparrow territories were monitored for any reproductive behavior primarily using the suggestions for following birds and detecting reproductive behavior described in the nest searching section of Ralph et al. (1993). Any reproductive behavior such as the presence of a female on a male's territory, nest building, food carrying, and the presence of fledglings was recorded. When a female was detected while collecting spotmapping data on a male; the female was immediately followed instead of the male. Because female sage sparrows can be difficult to follow, not losing the female took precedence over collecting detailed spotmapping data.

Results

Species List

A list of all bird species detected on the BCA in 2012 is shown in Table 1. For comparison, the table includes the species detected on the BCA from Omdal (2003) and Moore (2006), as well as the species detected on the NWSTF from Humple and Holmes (2001). There are 141 species listed in Table 1 which were detected on or adjacent to the BCA and NWSTF, of these, 124 bird species were observed in 2012 (Table 1). Several of the species not detected in 2012 either overwinter on the BCA, such as rough-legged hawks, or migrate early such as snow geese. These species were likely not detected in 2012 because the surveys started later in the

season in than in previous years. There were 41 species reported in 2012 that were not previously reported on the BCA or NWSTF. The majority of these species were detected in the riparian areas near Carty Reservoir. These areas were only searched incidentally when they were included in a sage sparrow area search plot. More intensive surveys of the riparian areas would likely detect more species than is currently reported. There were three rare species detected in 2012, two of these, red-breasted mergansers and a least tern were detected on Carty Reservoir, the third species, a small flock of common redpolls was detected on the BCA in Schoolhouse pasture.

Raptor Nests

In 2012 there were 29 raptor or corvid nests located either on, or immediately adjacent to the BCA (Figure 6). Swainson's hawks were the most common species found nesting on the BCA, and 14 Swainson's hawk nests were documented. However, some Swainson's hawk nests may have been re-nesting attempts following the failure of a nest. Additional diurnal raptor nests included three red-tailed hawk nests, one American kestrel nest, and three ferruginous hawk nests. There was one additional family of American kestrels that had recently fledged for which I was unable to find the nest. In addition, there was one ferruginous hawk nesting site where I was unable to determine the exact tree being used, and there was another ferruginous hawk pair, one of which had a radio tracking device, nesting just off the BCA by the old barn on the Ione-Boardman road. There were three long-eared owl nests, and one barn owl nest. However, all owl nests were inactive by the time they were discovered and were identified by feathers, whitewash, pellets, and in one case adult and nestling long-eared owl bits by a nest that seemed to have been depredated by a coyote. The only corvid nests documented were two common raven nests, however, American crows were observed several times throughout the season by Carty Reservoir, so may be nesting in the riparian areas. There were two nests that appeared recently active, but for which I was unable to determine the species.

Point Counts

Vegetation Assessment

Between 2003 and 2012, of the 61 point count stations, 19 changed in general vegetation type, 36 changed in vegetation classification, and 25 changed condition class (Table 2). The number of stations classified as shrub dominated decreased from 33% (n=20) in 2003 to 25% (n=15) in 2012. The decrease in shrub dominated stations was accompanied with increases in shrub/juniper, grass, and cheatgrass dominated stations (Figure 7). The two most common vegetation types at the point count stations in both 2003 and 2012 were HECO/POSE (n=16 both years), and POSE/BRTE (n=8 both years) (Figure 8). The number of point count stations in high condition stayed the same between years. The number of stations in Medium-High and Medium Condition decreased, and the number of stations in medium-low and low condition increased in 2012 (Figure 9). Only 8% (n=5) of the plots increased condition class in 2012. There was no change in condition class on 59% (n=36) of the plots, 21% (n=13) of the points decreased one condition class, and 12% (n=7) decreased two condition classes. More stations decreased condition class in unburned areas (n=12), than in burned areas (n=8) (Figure 10).

Bird Surveys

During the 2012 surveys, there were 2,122 total detections of 40 different species. Species abundance (SA) was examined by taking the average of the highest number of detections between the two visits at all stations for each species (Figure 11a). Species frequency (SF) was examined by taking the percentage of stations with at least one detection on either visit for each species (Figure 11b). The most abundant and widely distributed species were western meadowlarks (SA = 8.3, SF = 100%), horned larks (SA = 3.4, SF = 93.4%), common ravens (SA = 3.2, SF = 67.2%), grasshopper sparrows (SA = 1.4, SF = 78.7%), and long-billed curlews (SA = 1.4, SF = 67.2%). Canada goose also had one of the highest abundances, (SA = 1.6, SF = 11.5%), however, all birds detected were flying overhead or were located off the BCA at Carty Reservoir and could be heard from the stations.

To compare years SA was calculated for each species in each survey year. The most abundant species in all years were western meadowlarks and horned larks (Figure 12). Western

meadowlarks increased in abundance between 2003 (SA=5.8) and 2006 (SA=8.0), but there was little change between 2006 and 2012 (SA=8.3). There was little change in horned lark abundance between 2003 (SA=4.6) and 2006 (SA=4.9), but abundance decreased in 2012 (SA=3.4). There was little change in abundance of long-billed curlews between 2003 (SA=2.6) and 2006 (SA=2.3), but abundance decreased in 2012 (SA=1.4). Abundance of common ravens decreased slightly between 2003 (SA=2.0) and 2006 (SA=1.3), but then increased between in 2012 (SA=3.2). Abundance of grasshopper sparrows decreased slightly between 2003 (SA=0.5) and 2006 (SA=0.2), but then increased between in 2012 (SA=1.4). California gulls were infrequently detected in 2003 (SA=0.03) were very abundant in 2006 (SA=7.2), and decreased in abundance in 2012 (SA=1.2) (Figure 13).

Sage Sparrow Surveys

Inventory

There were 95 species detected on the 147 area search plots. Species frequency was examined by taking the percentage of plots on which each species was detected (Figure. 6). The most common species detected were Western Meadowlarks (97 %), Common Raven (63%), Lark Sparrow (56%), Horned Larks (37%), Cliff Swallows (32%), and Swainson's Hawks (32%). Several plots abutted or included riparian areas adjacent to Carty Reservoir, or small ponds in Railroad pasture. Detections from these riparian areas greatly contributed to the bird diversity recorded on these surveys.

Sagebrush dependent species were infrequently detected on the area search plots. Brewer's sparrows were detected on only 15 (10.2%) plots, sage thrashers were only detected on 6 (4.08%) plots, black-throated sparrows were only detected on 2 (1.36%) plots, and sage sparrows were detected on only 10 (6.8 %) of the plots (Figure 15). All but one sage sparrow detection were in the South Boeing/ Crawford area. There was one sage sparrow detected in Doherty pasture. No sage sparrows were detected in Schoolhouse pasture despite extensive searches of the territories identified in previous years, in addition to the area searches. The first sage sparrow detection occurred in the South Boeing area on May 8. The previous visit to the South Boeing area had occurred on April 12, indicating that sage sparrows either went undetected on the first visit, or arrived sometime between April 12 and May 8. This is a much

later arrival date than was observed in prior seasons. However, on April 12 plots 220 and 211 were searched, both of which later contained territories of extremely vociferous male sage sparrows (BCA-1 & BCA-2), so it seems unlikely that they would have gone undetected if they were present. There were two additional plots (210 & 217) where sage sparrows were not detected during the area search which actually did intersect sage sparrows territories. Plot 217 was overlapped by the territory of BCA-5. This sage sparrow was not present in that part of his territory until much later in the season, so was most likely not present at the time the area search survey occurred. Plot 210 contained BCA-12. This bird was heard singing extremely infrequently later in the season, but was never located, so it is unsurprising that he went undetected during the area search survey. There were two plots (209 & 198) in which sage sparrows were detected which did not contain territories. The sage sparrows detected while surveying #209 and #198 were aural detections off plot from the direction of the known territories.

Territory Mapping

There were seven sage sparrow territories (BCA-1-6, BCA-9) that were confirmed by at least three visits where the bird was followed for at least 20 minutes (Table 3, Figure 16). There were four sage sparrow territories (BCA-7, BCA-10-12) that were unconfirmed (Table 3, Figure 16). The males in all four of the unconfirmed territories were detected based on counter-singing with other males in confirmed territories. However repeated attempts to locate and follow these birds proved unsuccessful. There was no way to determine if these unconfirmed territories were each held by a single male throughout the season, or if they were areas only used intermittently. The one transient male, (BCA-8), located in Doherty pasture was detected and followed on June 14, but was never relocated (Table 3, Figure 17). This detection was next to a road that was used frequently to walk in and out of Doherty pasture, so it is unlikely that the male was present in this area prior to the detection on June 14.

Visually it appears that sage sparrow territories frequently followed natural boundaries of sagebrush and hills (Figure 16). Several of the sage sparrow territories overlapped; however, this typically occurred as the areas used by the birds shifted throughout the season, so that overlaps did not usually occur at the same time. One exception is the overlap between BCA-6, 9, & 11; where sage sparrows from multiple territories began to form flocks late in July. Excluding the

unconfirmed territories, as well as BCA-5, territory sizes ranged from 3.28- 7.91 hectares, with a mean of 4.79±1.61 hectares (Table 3). The male in BCA-5 had a unique song, (typically added an extra syllable or two at the end of his songs), that was never heard from another bird. This bird moved further westward on every visit, but was readily identified based on his song. This resulted in an extremely large, (13.16 hectares), two-parted territory (Table 3, Figure 16).The male in the second largest territory, BCA-6, was initially only found in the central part of his territory, but expanded his singing patrols to include perches in areas of the eastern part of BCA-5 once it was abandoned.

Reproductive Success

All but one (BCA-4) of the seven males from confirmed territories were considered paired (Table 3). Females were detected in five of the confirmed territories. The presence of a fledgling in the sixth territory, (BCA-2), indicated that an undetected female had been present in this territory. Fledglings were detected in four territories, (BCA-2, 3, 6, & 9), and the number of fledglings observed ranged from 0-3 (mean = 1 ±1.15) (Table 3). The only fledglings detected in June were seen in BCA-3, where a pair with two fledglings was detected on June 1 by CAE, and on June 6 by MM. The remaining fledglings were detected in late July. In BCA-2, a male was observed feeding a single fledgling on July 18. In BCA-6, a male was observed with one younger fledgling on July 23, and on July 25. A pair with three fledglings flew across BCA-11 through BCA-6/9 to BCA-2 then back to BCA-6/9 on July 23. This pair was most likely the pair from BCA-9, who had been seen frequently at a potential nest site near the area for several weeks prior.

There were six detections of 1-3 juveniles each which could not be assigned to a territory (Table 4). In all of these instances the juveniles looked older than the fledglings seen with adults in territories, and appeared to be dispersing independently. Two of the detections were of juvenile sage sparrows that appeared to be flocking with lark sparrows. The detection of three juveniles on July 26 may have been the same fledglings detected in the same area with a pair on July 23. Fesenmyer and Knick (2011) found that post-breeding juvenile (HY) birds dispersed at greater distances than adult (AHY) birds, and that the median dispersal distance of HY birds (17.5 hectares) during their study was much larger than breeding territories (1-2 hectares). This

indicates that older HY birds observed independent of adults cannot reasonably be determined to originate from specific territories, or even potentially from the BCA.

Discussion

Point Counts

Since the bird surveys began in 2003 there have been changes in both vegetation and bird abundance (Figures 7-10, 12-13). The changes in grassland bird abundance may be a response the 2008 wildfire, vegetation changes following the discontinuation of grazing, or other factors contributing to the ubiquitous decline of grassland birds (Vickery et al. 1999, Brennan and Kuvlesky 2005). However, the grassland species on the BCA have responded differently to the vegetation changes with western meadowlarks and grasshopper sparrows increasing in abundance, while long-billed curlews and horned larks decreased in abundance (Figure 13).

Sage Sparrow Surveys

Unfortunately, due to the inconsistency in methods between survey years and lack of records of areas searched in previous years, it is impossible to determine if sage sparrow populations are increasing or decreasing on the BCA. Based solely on overall territory numbers it would seem that the population initially decreased from nine territories in 2003 to six territories in 2006, and then remained steady at six to seven territories in the three surveys between 2006-2012 (Table 5). In 2012, by putting substantial effort into recording counter-singing events, territories could be separated which likely would have been combined into a single territory using the previous methods. This implies that the 2012 methods used to map territories in 2012 would have a higher detection rate for sage sparrows than the territory mapping methods used in previous years, and that any apparent increases or stability in territory numbers may be an artifact of the differences in methodology between survey years.

What we can tell from the four surveys is that the range of sage sparrows on the BCA has contracted (Figure 18). In 2003, the first survey year, sage sparrows territories were located in the Schoolhouse, South Boeing, and Rugg Well/Cowboy areas. In the Rugg Well/Cowboy area, sage sparrows were no longer detected in any following survey years, and in the Schoolhouse

area, the number of territories decreased in each survey period until 2012 when no sage sparrows were detected (Table 5). The Schoolhouse area is easily accessible, and was originally reported as containing the highest number of sage sparrow territories. Consequently, survey effort was likely concentrated in the Schoolhouse area in all survey years, increasing the probability of detection for sage sparrows in this area.

The South Boeing area is the only area on the BCA in which sage sparrows were detected during all four surveys, and based on the number of territories reported each year it would appear that the number of sage sparrow territories increased over the four survey periods (Table 5). However, as was noted previously, it is impossible to determine if this represents an actual increase in the number of territories, or if the increase could be explained due to differences between years in survey methods or survey effort and extent. The South Boeing area probably received substantially less survey effort in prior years because it is less accessible than the Schoolhouse and Rugg Well/Cowboy areas. Also, the South Boeing area is characterized by sandy soil rather than the cryptobiotic crusts of the Schoolhouse area, and was originally thought to be less suitable habitat for sage sparrows (Omdal 2003, Moore 2006).

Retroactively identifying the cause of the disappearance of sage sparrows from the Schoolhouse and Rugg Well/Cowboy pastures is problematic and unfeasible. Habitat changes on the BCA that may have influenced sage sparrow populations include the 2008 wildfire, and increases in juniper and/or cheatgrass in sagebrush habitats. While the 2008 burn reduced sagebrush habitat on the BCA, it did not burn the Schoolhouse and Rugg Well/Cowboy pastures (Figure 2, Elseroad 2011). Sage sparrows are negatively associated with cheatgrass (Holmes and Guepel 1998). Increases in cheatgrass were observed following the discontinuation of grazing, (Elseroad 2011), which may have reduced habitat suitability for sage sparrows. Although some researchers believe that grazing cessation will not restore sagebrush habitats (Davies et al. 2011); many others have found that grazing is detrimental to shrubsteppe habitats and that discontinuing grazing is an important restoration action (Fleischner 1994, Yeo 2005, Hartway and Mills 2012). Encroachment of juniper into sagebrush habitats has been shown to negatively affect populations of sagebrush dependent birds (Noson et al. 2006, Reinkensmeyer et al. 2007). On the BCA, juniper encroachment appears to be limited to the sandy soil habitats which can be found in Rugg Well/Cowboy, Doherty, and South Boeing pastures, but not in Schoolhouse (Elseroad 2011).

In the Columbia Plateau, sage sparrow populations declined at a high rate between 1997-2007 (Earnst et al. 2009), and similiarly declined at -4.7 % in Oregon between 2000-2010 (Sauer et al 2011). Loss of sagebrush habitat is generally believed to be the primary cause of sage sparrow population declines, due to their dependence on large patches of sagebrush, and sensitivity to fragmentation (Knick and Rotenberry 1995, 1999, Rotenberry and Knick 1999, Vander Haegen et al. 2000, Vander Haegen 2007). Kagan et al. (2000) showed that the sagebrush steppe habitats are the most critical and limiting to a set of target wildlife species, including the sage sparrow, within the lower Umatilla Basin, with most available sagebrush habitat occurring on the BCA and NWSTF. This is compounded by the fact that much of the sagebrush habitat on the BCA was lost in the 2008 wildfire, and sagebrush habitat has decreased due to large wildfires on the NWSTF in 1998, 2007, & 2008 (USDON 2012). Additionally, sage sparrow territories decreased on the NWSTF in response to the 1998 wildfire (Humple and Holmes 2001), and it is likely that sage sparrow numbers on the BCA and NWSTF would have further decreased in response to the loss of sagebrush habitat from the frequent wildfires in subsequent years. Therefore, on a a landscape level, availability of sagebrush habitats on the BCA and NWSTF should be limiting to sage sparrow populations.

However, sage sparrow territories on the BCA in 2012 are on the largest end of the spectrum for documented sizes of sage sparrow territories at a mean of 4.79±1.61 hectares (Table 3). Wiens et al. (1985) looked at 113 sage sparrow territories in Oregon, Washington, and Nevada and found that the mean territory size on all sites but one fell between 0.65- 3.88 hectares, with three territories on the remaining site between 5.49-5.81 hectares. The majority of sage sparrow territories in this study fell between 1-2 hectares (Wiens et al. 1985). Similarly, sage sparrow territories in southern California ranged from 1-2 hectares (Misenhelter and Rotenberry 2000), and 37 sage sparrow territories mapped on Central Hanford, which is in the Columbia Basin Ecoregion in Washington, ranged between 0.3-2.55 hectares, with most territories smaller than 1 hectare (Duberstein et al. 2008).

In addition to occupying extremely large territories, sage sparrows, such as BCA-5 and BCA-6, were documented moving into unoccupied habitat throughout the season, and unburned territories occupied in previous years went unoccupied. This suggests that there is suitable habitat unused by sage sparrows on the BCA, and that while availability of habitat may have

limited sage sparrow populations on the BCA in the past, currently some other factor may be limiting sage sparrow populations.

Alternatively, there may no longer be suitable sage sparrow habitat on the BCA. The high site fidelity of shrubsteppe birds can cause a temporary uncoupling of species presence and habitat quality (Rotenberry and Wiens 2009). This phenomenon was described as a "ghost of habitat past" by Knick and Rotenberry (2000) where species occurrence is related to a "memory" of past habitat conditions rather than a response to current conditions. In this situation occupancy is driven by site tenacity rather than habitat quality, and it may take more than a decade for a species distribution and habitat quality to come to equilibrium (Rotenberry and Wiens 2009).

If there is unoccupied suitable habitat on the BCA, other potential factors that could influence sage sparrow populations include predation, intra-specific competition for resources, contamination issues from the PGE coal plant, or unidentified limitations in resources other than habitat.

Known predators of sage sparrow adults include loggerhead shrikes and raptors (Holmes and Johnson 2005). During the 2012 surveys on the BCA two predation attempts on sage sparrows were observed by loggerhead shrikes. Additionally, on separate occasions a northern harrier and a red-tail hawk attacked the mp3 player while broadcasting a sage sparrow song. There was a large pack of coyotes frequently observed in South Boeing in 2012, and one possible predation attempt was observed. Known sage sparrow nest predators include common ravens, black-billed magpies, Townsend's ground squirrels, snakes, long-tailed weasels, and chipmunks (Holmes and Johnson 2005). The abundance of common ravens on the BCA has increased since 2003, two nests were located in 2012, and large flocks were frequently observed flying over the shrubsteppe, particularly in the Schoolhouse pasture (Figures 6 &13). Parasitism by brown-headed cowbirds has been shown to occur in sage sparrows nests (Vander Haegen and Walker 1999). However, brown-headed cowbirds were only detected on 6.12 % of the area search plots on the BCA (Figure 14) and most of the detections occurred near Carty Reservoir.

High numbers of predators in sagebrush habitats on the BCA may be attracted by the presence of fences and other manmade structures, juniper trees, and fragmentation. Artificial perches such as fence lines and other manmade structures are known to attract avian predators including raptors, corvids, and shrikes (Stahlecker 1978, Wolff et al. 1999, Meunier et al. 2000, Sheffield et al. 2001, Kim et al. 2003, Manzer and Hannon 2005, Hawlena et al. 2010, Prather and Messmer 2010). Juniper trees in sagebrush habitats on the BCA are utilized as nest sites and perches by raptors, common ravens, black-billed magpies, and loggerhead shrikes (Figure 6). Populations of sage sparrow predators are higher in fragmented sagebrush habitats which subsequently decreases reproductive success in sage sparrows (Vander Haegen 2007). In one study, Reynolds (1979) observed that loggerhead shrikes were such successful nest predators that they eliminated reproduction of sage sparrows, along with two other sagebrush associated passerines, on his study plots. Loggerhead shrikes and other predators serve an important ecological function by regulating passerine populations. However, in the shrubsteppe areas on the BCA, avian passerine predators are more abundant than sage sparrows (Figure 14); and sage sparrow populations may not have a high enough reproductive rate to withstand high predation rates. Additionally, Hartway and Mills (2012) found that predator control was one of the most effective management actions in increasing nest success.

Rotenberry and Wiens (1989), found evidence of interspecific competition between sage sparrows and Brewer's sparrows where sage sparrow reproductive success was negatively associated with Brewer's sparrow density, however the authors believed that the association may have been incidental. There were a small number of Brewer's sparrows that did nest near sage sparrow territories on the BCA, but no negative interactions were observed between the two species in 2012. While interspecific competition between sage sparrows and Brewer's sparrows seems unlikely on the BCA, numerous instances of lark sparrows and sage sparrows chasing each other were observed in 2012.

One environmental threat unique to the BCA and NWSTF is the presence of the operational PGE coal plant. Negative effects of exposure to air pollution from coal plants in birds can include accumulation of metals, physiological changes, and potentially genotoxic effects (Saldiva and Bohm 1998). Metals shown to accumulate in birds as a result of exposure to air

pollution from coal plants include Cr, Al, As, Cd, and Se (Llacuna et al. 1995, Bryan et al. 2003, Bryan et al. 2012). Selenium from coal fly-ash has been shown to accumulate in bird eggs, and to reach levels of concern in the livers of nestlings (Bryan et al. 2003, Bryan et al. 2012) . Exposure to selenium may cause reduced reproductive success or teratogenic effects in birds (Ohlendorf 2003). Inhalation of gas and particulate emissions from coal plants may cause a histological response in birds shown by increases in ciliated cells in the tracheal epithelium (Gorriz et al. 1994), this indicates impairment in respiratory defenses which may leave an animal more susceptible to respiratory infections (Saldiva and Bohm 1998). Exposure to air pollution from coal plants has also been shown to cause changes in hematological parameters in birds indicative of a response to environmental stress (Gorriz et al. 1996). Additionally, air pollution from coal plants has been shown to negatively impact foraging behavior of birds (Brotons et al. 1998). Although it has never been documented, sage sparrows in the South Boeing pasture are almost certainly exposed to pollution from the coal plant. South Boeing pasture is immediately adjacent to the PGE coal plant, with most of the 2012 sage sparrow territories ~ 2-3 km downwind of the coal plant; and clouds of dark particulates from the coal plant were observed blowing over the South Boeing pasture numerous times throughout the 2012 season. However, it is unknown whether exposures to contaminants from the coal plant are affecting sage sparrows on the BCA.

Future Survey Recommendations

The scope of this study is too large for a single observer, as was noted by Omdal (2003), and Moore (2006). The time it takes to search all available sagebrush habitat on the BCA does not leave adequate time for monitoring sage sparrow territories. Additionally, very little monitoring could occur on a sage sparrow detected late in the season during the area searches. I suggest either 1) dropping the area searches and focusing on a demographic study in the South Boeing area, or 2) obtaining enough manpower to complete the area searches in a two-week window early in the season, after SAGS were first detected in South Boeing. If area searches were limited to a maximum of 45 minutes a plot, and were only conducted in the morning, three observers should be able to complete the 147 area searches in ~ 10 days. Additionally, if time allowed, a second round of surveys of all or some of the plots should be considered.

Improved demographic monitoring of sage sparrow populations on the BCA is imperative in 1) determining the cause of the range contraction observed on the BCA, 2) determining which demographic rates could be influenced to increase sage sparrow numbers on the BCA, and 3) devising possible management actions which may result in increased productivity and recruitment. The demographic monitoring should include color-banding sage sparrows, and an increased emphasis on nest searching. Color-banding sage sparrows would increase the accuracy of mapping territories, could provide information on site fidelity, survival, and recruitment, and would be invaluable in assigning fledglings to territories as family groups can move widely post-fledging (such as the family group observed on July 23 (Table2)).

Nest monitoring would provide an understanding of the mechanisms limiting population growth of sage sparrows on the BCA. Some nest searching using behavioral observations was attempted in 2012, but little time was available to focus on nest searching, and all attempts were unsuccessful. However, there are numerous other studies in which researchers have been extremely successful finding and monitoring sage sparrow nests when that has been one of the primary objectives (Reynolds 1981, Winter and Best 1985, Petersen and Best 1987, Rotenberry and Wiens 1989, 1991, Vander Haegen and Walker 1999, Vander Haegen 2007). Although there were not many sage sparrow territories located on the BCA, they occurred over an area that was 2 km x 1.5 km. Because of the large search area and large territories it would require two to three observers to adequately cover the area. In addition, because there are so few sage sparrows, monitoring the nests of other sparrows in the area, such as lark sparrows and brewer's sparrows, may provide additional insight towards the main stresses on shrubsteppe bird populations on the BCA.

Additionally, nest searching would increase the accountability of the monitoring program as there have been several recent studies criticizing the use of reproductive cues, such as searching for fledglings, as unreliable indicators of reproductive success in comparison to nest searching and monitoring (Rivers et al. 2003, Morgan et al. 2010).

Sage sparrow song patterns or dialects vary greatly between populations (Rich 1981, Wiens 1982). However, the metapopulation dynamics, such as isolation, emigration, and immigration, as well as the genetic relatedness between populations, associated with this local variation in song are unknown (Holmes and Johnson 2005). Sage sparrows on the BCA and

NWSTF sing a unique song that is distinct from any published recordings of sage sparrow songs (Borror Laboratory of Bioacoustics, Macaulay Library, accessed 2012). The current limitation of sagebrush habitat within the Umatilla plateau to the BCA and NWSTF suggests that habitat loss and fragmentation may have resulted in an isolated sage sparrow subpopulation on the BCA and NWSTF. There are only a small number of sage sparrow territories on the BCA (n=7) and NWSTF (n=34 in 2001 (Humple and Holmes (2001), currently unknown). Because of the small population size, it is imperative that conservation actions are implemented to preserve the unique subpopulation of sage sparrows on the BCA and NWSTF.

Management Recommendations

- Increase available habitat by increasing connectivity between all of the large sagebrush patches including the areas between Schoolhouse and Rugg Well, Cowboy and Doherty, and Doherty and Crawford/South Boeing (Figure 2). Connectivity could be improved by seeding sagebrush between the existing large sagebrush patches.

- Decrease fragmentation in sagebrush patches, particularly South Boeing, by reducing cheatgrass and juniper, and increasing sagebrush between existing sagebrush patches. Some replanting of sagebrush has already occurred here following the 2008 wildfire.

- Identify large cheatgrass patches in the South Boeing pasture. Explore restoration methods of targeted cheatgrass eradication in any large patches of cheatgrass. Eradication of the largest cheatgrass patches should help prevent invasion of cheatgrass into the sandy soils of the South Boeing pasture, and retain bare ground for the sage sparrows. Eradication of the large cheatgrass patches should also reduce the intensity of future wildfires in the sagebrush.

- Implement fire suppression to protect the remaining large patches of sagebrush, particularly South Boeing, and any remaining sagebrush habitat supporting sage sparrows on the NWSTF.

- Determine sources of predation and reduce attractants such as artificial perch sites and junipers. Determining the primary predators of sage sparrow adults, fledglings, and nests on the BCA will require more intensive study.

- Reduce juniper encroachment in shrubsteppe patches, particularly in South Boeing, Doherty, and Rugg Well/Cowboy. However, care should be taken to retain large junipers at known and historic ferruginous hawk nest sites.

- Artificial perches such as fence lines and other manmade structures are known to attract avian predators including raptors, corvids, and shrikes. It should be beneficial to sage sparrows to remove all possible fence posts or other artificial perches, especially within sagebrush habitats. For fencelines in the sagebrush areas which cannot be removed, alternative measures could be implemented such as the use of non-barbed wire, and perch deterrents.

Tables

Table 1: Species detected on the BCA in 2012, 2006, and 2003, and the NWSTF in 2001.

SPECIES NAME	CODE	NWSTF_2001*	BCA_2003**	BCA_2006***	BCA_2012	STATUS
LOONS, GREBES						
Pied-billed Grebe - Podilymbus podiceps	PBGR				■	b
PELICANS, CORMORANTS						
American White Pelican - Pelecanus erythrorhynchos	AWPE				■	f,1t
Double-crested Cormorant - Phalacrocorax auritus	DCCO			■	■	f,1t
WADING BIRDS						
Great Blue Heron - Ardea herodias	GBHE	■			■	f
Great Egret - Ardea alba	GREG				■	1
Black-crowned Night-heron - Nycticorax nycticorax	BCNH	■				
SWANS, GEESE, DUCKS						
Canada Goose - Branta canadensis	CANG		■	■	■	f,1b
Snow Goose - Chen caerulescens	SNGO	■		■		m
Mallard - Anas platyrhynchos	MALL	■	■	■	■	b
Blue-winged Teal - Anas discors	BWTE				■	t
Cinnamon Teal - Anas cyanoptera	CITE			■	■	1t
Northern Shoveler - Anas clypeata	NOSH				■	
Green-winged Teal - Anas crecca	GWTE				■	t
Redhead - Aythya americana	REDH				■	b
Ring-necked Duck - Aythya collaris	RNDU			■	■	b
Lesser Scaup - Aythya affinis	LESC				■	
Bufflehead - Bucephala albeola	BUFF			■		m
Red-breasted Merganser - Mergus serrator	RBME				■	1,m,r
Ruddy Duck - Oxyura jamaicensis	RUDU			■	■	b
DIURNAL RAPTORS						
Turkey Vulture - Cathartes aura	TUVU	■				
Northern Harrier - Circus cyaneus	NOHA	■	■	■	■	b
Sharp-shinned Hawk - Accipiter striatus	SHHA	■		■	■	m
Cooper's Hawk - Accipiter cooperii	COHA			■	■	
Swainson's Hawk - Buteo swainsoni	SWHA	■	■	■	■	b
Red-tailed Hawk - Buteo jamaicensis	RTHA	■		■	■	b
Ferruginous Hawk - Buteo regalis	FEHA	■	■	■	■	b
Rough-legged Hawk - Buteo lagopus	RLHA	■		■		m
Golden Eagle - Aquila chrysaetos	GOEA	■		■	■	b
Bald Eagle - Haliaeetus leucocephalus	BAEA				■	1,m
Osprey - Pandion haliaetus	OSPR				■	1b
Merlin - Falco columbarius	MERL				■	m
American Kestrel - Falco sparverius	AMKE	■	■	■	■	b
Prairie Falcon - Falco mexicanus	PRFA	■	■	■	■	
UPLAND GAME BIRDS						
California Quail - Callipepla californica	CAQU		■	■	■	b
Chukar - Alectoris chukar	CHUK			■	■	b
Gray Partridge - Perdix perdix	GRAP	■			■	b
Ring-necked Pheasant - Phasianus colchicus	RNEP	■	■	■	■	b
Wild Turkey - Meleagris gallopavo	WITU				■	
COOTS, RAILS, CRANES						
American Coot - Fulica americana	AMCO			■	■	b
SHOREBIRDS						
Killdeer - Charadrius vociferus	KILL	■	■	■	■	b
American Avocet - Recurvirostra americana	AMAV				■	
Black-necked Stilt - Himantopus mexicanus	BNST				■	
Long-billed Curlew - Numenius americanus	LBCU	■	■	■	■	b
Least Sandpiper - Calidris minutilla	LESA				■	1m
Wilson's Phalarope - Phalaropus tricolor	WIPH				■	
Red-necked Phalarope - Phalaropus lobatus	RNPH				■	m

Table 1: (Cont.)

SPECIES NAME	CODE	NWSTF_2001*	BCA_2003**	BCA_2006***	BCA_2012	STATUS
GULLS						
Ring-billed Gull - Larus delawarensis	RBGU	■		■	■	f,1t
California Gull - Larus californicus	CAGU		■	■	■	f,1b
Caspian Tern - Hydroprogne caspia	CATE				■	f,1t
Forster's Tern - Sterna forsteri	FOTE				■	f
Least Tern - Sternula antillarum	LETE				■	1,r
DOVES, PIGEONS						
Mourning Dove - Zenaida macroura	MODO	■	■	■	■	b
Eurasian Collared-Dove - Streptopelia decaocto	EUCD			■	■	b
Rock Pigeon - Columba livia	ROPI	■			■	
OWLS						
Barn Owl - Tyto alba	BANO	■		■	■	b
Long-eared Owl - Asio otus	LEOW	■			■	b
Short-eared Owl - Asio flammeus	SEOW	■			■	b
Great Horned Owl - Bubo virginianus	GHOW			■	■	b
Burrowing Owl - Athene cunicularia	BUOW	■				b
GOATSUCKERS, SWIFTS						
Common Nighthawk - Chordeiles minor	CONI	■	■	■	■	b
Vaux's Swift - Chaetura vauxi	VAUX				■	1
HUMMINGBIRDS						
Black-chinned Hummingbird - Archilochus alexandri	BCHU				■	
Rufous Hummingbird - Selasphorus rufus	RUHU				■	
WOODPECKERS						
Downy Woodpecker - Picoides pubescens	DOWO			■	■	
Northern Flicker - Colaptes auratus	NOFL	■		■	■	b
FLYCATCHERS						
Olive-sided Flycatcher - Contopus cooperi	OSFL				■	m
Western Wood-Pewee - Contopus sordidulus	WEWP			■	■	t
Willow Flycatcher - Empidonax traillii	WIFL				■	
Pacific-slope Flycatcher - Empidonax difficilis	PSFL				■	m
Dusky Flycatcher - Empidonax oberholseri	DUFL	■		■	■	m
Gray Flycatcher - Empidonax wrightii	GRFL			■	■	b
Say's Phoebe - Sayornis saya	SAPH	■		■	■	
Western Kingbird - Tyrannus verticalis	WEKI	■	■	■	■	b
Eastern Kingbird - Tyrannus tyrannus	EAKI				■	b
SHRIKES, VIREOS						
Northern Shrike - Lanius excubitor	NOSH			■		
Loggerhead Shrike - Lanius ludovicianus	LOSH	■	■	■	■	b
Red-eyed Vireo - Vireo olivaceus	REVI				■	
Cassin's Vireo - Vireo cassinii	CAVI				■	
Warbling Vireo - Vireo gilvus	WAVI				■	
JAYS, CROWS						
Black-billed Magpie - Pica hudsonia	BBMA	■	■	■	■	b
American Crow - Corvus brachyrhynchos	AMCR	■			■	t
Common Raven - Corvus corax	CORA	■	■	■	■	b
LARKS						
Horned Lark - Eremophila alpestris	HOLA	■	■	■	■	b
SWALLOWS						
Northern Rough-winged Swallow - Stelgidopteryx serripennis	NRWS	■		■	■	b
Tree Swallow - Tachycineta bicolor	TRES	■		■	■	
Bank Swallow - Riparia riparia	BANS	■		■	■	
Barn Swallow - Hirundo rustica	BARS	■	■	■	■	b
Cliff Swallow - Petrochelidon pyrrhonota	CLSW	■	■	■	■	b
Violet-green Swallow - Tachycineta thalassina	VGSW	■				

Table 1: (Cont.)

SPECIES NAME	CODE	NWSTF_2001*	BCA_2003**	BCA_2006***	BCA_2012	STATUS
CHICKADEES						
Mountain Chickadee - Poecile gambeli	MOCH	■				
WRENS						
Rock Wren - Salpinctes obsoletus	ROWR	■	■		■	t
House Wren - Troglodytes aedon	HOWR			■	■	
Pacific Wren - Troglodytes pacificus	PAWR				■	
Marsh Wren - Cistothorus palustris	MAWR				■	t
KINGLETS						
Golden-crowned Kinglet - Regulus satrapa	GCKI	■			■	m
Ruby-crowned Kinglet - Regulus calendula	RCKI	■			■	m
THRUSHES						
American Robin - Turdus migratorius	AMRO	■			■	b
Hermit Thrush - Catharus guttatus	HETH	■				
Mountain Bluebird - Sialia currucoides	MOBL	■				
Western Bluebird - Sialia mexicana	WEBL	■				
THRASHERS						
Sage Thrasher - Oreoscoptes montanus	SATH	■		■	■	b
STARLINGS						
European Starling - Sturnus vulgaris	EUST	■	■	■	■	b
PIPITS						
American Pipit - Anthus rubescens	AMPI			■		m
WAXWINGS						
Cedar Waxwing - Bombycilla cedrorum	CEDW				■	
WARBLERS						
Orange-crowned Warbler - Oreothlypis celata	OCWA			■	■	
Nashville Warbler - Oreothlypis ruficapilla	NAWA				■	
MacGillivray's Warbler - Geothlypis tolmiei	MGWA				■	t
Yellow Warbler - Setophaga petechia	YEWA			■	■	
Yellow-rumped Warbler - Setophaga coronata	YRWA	■		■	■	m
Townsend's Warbler - Setophaga townsendi	TOWA	■			■	m
Wilson's Warbler - Cardellina pusilla	WIWA				■	
Yellow-breasted Chat - Icteria virens	YBCH				■	
TANAGERS, BUNTINGS, GROSBEAKS						
Western Tanager - Piranga ludoviciana	WETA				■	
Black-headed Grosbeak - Pheucticus melanocephalus	BHGR	■			■	t
Lazuli Bunting - Passerina amoena	LAZB			■	■	t
SPARROWS						
Green-tailed Towhee - Pipilo chlorurus	GTTO			■	■	
Spotted Towhee - Pipilo maculatus	SPTO	■		■	■	
Sage Sparrow - Artemisiospiza belli	SAGS	■	■	■	■	b
Black-throated Sparrow - Amphispiza bilineata	BTSP			■	■	t
Chipping Sparrow - Spizella passerina	CHSP	■		■	■	
Brewer's Sparrow - Spizella breweri	BRSP	■		■	■	b
Grasshopper Sparrow - Ammodramus savannarum	GRSP	■	■	■	■	b
Vesper Sparrow - Pooecetes gramineus	VESP	■			■	m
Lark Sparrow - Chondestes grammacus	LASP	■	■	■	■	b
Savannah Sparrow - Passerculus sandwichensis	SAVS	■	■	■	■	m
White-crowned Sparrow - Zonotrichia leucophrys	WCSP	■	■	■	■	m
Golden-crowned Sparrow - Zonotrichia atricapilla	GCSP	■				m
Fox Sparrow - Passerella iliaca	FOSP			■		
Song Sparrow - Melospiza melodia	SOSP				■	t
Lincoln's Sparrow - Melospiza lincolnii	LISP			■		
Dark-eyed Junco (Oregon) - Junco hyemalis	DEJU	■		■		

Table 1: (Cont.)

SPECIES NAME	CODE	NWSTF_2001*	BCA_2003**	BCA_2006***	BCA_2012	STATUS
BLACKBIRDS, ORIOLES						
Western Meadowlark - Sturnella neglecta	WEME					b
Brown-headed Cowbird - Molothrus ater	BHCO					t
Red-winged Blackbird - Agelaius phoeniceus	RWBL					b
Yellow-headed Blackbird - Xanthocephalus xanthocephalus	YHBL					b
Brewer's Blackbird - Euphagus cyanocephalus	BRBL					b
Bullock's Oriole - Icterus bullockii	BUOR					b
FINCHES						
House Finch - Haemorhous mexicanus	HOFI					
Common Redpoll - Acanthis flammea	CORE					m,r
American Goldfinch - Spinus tristis	AMGO					
House Sparrow - Passer domesticus	HOSP					b

STATUS CODES

- f Birds seen flying over BCA, not using resources.
- m Birds likely to be seen on the BCA only during migration or winter
- t Birds exhibiting territorial behavior, suspected breeders
- b Birds confirmed as breeders
- 1 seen adjacent to BCA, probably occurs on BCA
- 1b confirmed breeders adjacent to BCA
- 1t suspected breeders adjacent to BCA
- r rare

* from Humple and Holmes 2001
** from Omdal 2003
*** from Moore 2006
(species codes from earlier publications were altered to reflect current BBL codes)

Table 2: Vegetation at point count stations in 2003 and 2012.

PLOT	2008 Burn	General_ Type		Vegetation_Classification		Condition	
		2003	2012	2003	2012	2003	2012
101	N	Shrub	Shrub	ARTRTR/PSSP/POSE	ARTRTR/POSE	M	ML
102	N	Grass	Grass	POSE/BRTE	POSE/BRTE	ML	ML
103	N	Shrub	Shrub	ARTRTR/PSSP/POSE	ARTRTR/PSSP/POSE	MH	MH
104	N	Grass	Grass	POSE/BRTE	POSE/BRTE	ML	L
105	N	Grass	Shrub	POSE/BRTE	ARTRTR/POSE/BRTE	ML	ML
106	N	Grass	Grass	POSE/BRTE	POSE/BRTE	ML	ML
107	N	Shrub/Juniper	Shrub/Juniper	JUOC/POSE	JUOC/POSE	M	M
108	N	Grass	Shrub/Juniper	HECO/POSE	JUOC/HECO/POSE	MH	MH
109	N	Grass	Grass	HECO/POSE	HECO/POSE	MH	ML
110	N	Grass	Shrub/Juniper	HECO/POSE	JUOC/HECO/POSE	H	H
111	N	Grass	Grass	POSE/BRTE	POSE/BRTE	ML	ML
112	N	Shrub	Shrub	ERNA/BRTE	ERNA/BRTE	L	L
113	N	Shrub	Shrub	ERNA/BRTE	ERNA/BRTE	L	L
114	N	Grass/Cheatgrass	Shrub	BRTE	ERNA/BRTE/TACA	L	L
115	N	Shrub	Grass	ERNA/BRTE	PSSP/BRTE	L	ML
116	N	Grass	Grass	PSSP/HECO	PSSP/HECO	MH	MH
117	N	Grass	Grass	HECO/POSE	HECO/POSE	M	M
118	N	Grass	Grass	HECO/POSE	HECO/POSE	MH	M
119	N	Shrub	Shrub	ERNA/POSE/BRTE	ERNA/BRTE	ML	L
120	N	Grass	Cheatgrass	POSE/BRTE	BRTE	ML	L
121	N	Grass/Cheatgrass	Grass/Cheatgrass	POSE/BRTE	HECO/BRTE	L	L
122	N	Grass	Grass	HECO/POSE	HECO/TACA	M	L
123	N	Grass	Grass	PSSP/HECO	PSSP/POSE	MH	ML
124	N	Grass	Grass	PSSP/HECO	PSSP/HECO	MH	ML
125	N	Grass	Grass	PSSP/HECO	PSSP/HECO/POSE	H	H
126	N	Grass	Grass	PSSP/HECO	PSSP/POSE	ML	M
127	Y	Grass	Grass	PSSP/HECO	PSSP/HECO/POSE	MH	MH
128	Y	Shrub/Juniper	Grass	JUOC/ARTRTR/BRTE	POSE/BRTE	M	L
129	Y	Grass	Grass	HECO/POSE	PSSP/POSE	H	H
130	Y	Shrub	Grass	ARTRTR/HECO	PSSP/POSE	MH	MH
131	Y	Shrub	Cheatgrass	ARTRTR/BRTE	BRTE	ML	L
132	Y	Grass	Grass	AGCR/POSE	AGCR/POSE	ML	ML
133	Y	Grass	Grass	POSE/BRTE	POSE/BRTE	ML	M
134	Y	Shrub	Shrub	ERNA/HECO	HECO /POSE	ML	M
135	Y	Shrub	Shrub	ERNA/POSE	HECO/POSE/BRTE	ML	ML
136	Y	Grass	Grass	HECO/POSE	PSSP/POSE	MH	MH
137	Y	Shrub	Cheatgrass	ARTRTR/BRTE	BRTE	ML	ML
138	Y	Shrub	Grass	ARTRTR/HECO	PSSP/HECO/POSE	MH	MH
139	Y	Shrub/Juniper	Shrub/Juniper	JUOC/ARTRTR/BRTE	JUOC/BRTE	M	L
140	Y	Shrub/Juniper	Shrub/Juniper	JUOC/ARTRTR/BRTE	JUOC/BRTE	M	L
141	Y	Shrub/Juniper	Shrub/Juniper	JUOC/ARTRTR/BRTE	JUOC/ARTRTR/BRTE	ML	ML
142	Y	Shrub/Juniper	Shrub/Juniper	JUOC/ARTRTR/BRTE	JUOC/ARTRTR/BRTE	ML	ML
143	N	Grass	Shrub	HECO/BRTE	HECO/BRTE	M	M
144	Y	Grass	Shrub	ELLA/HECO/BRTE	POSE/BRTE	ML	ML
145	Y	Grass	Grass	HECO/POSE/BRTE	HECO/POSE	M	ML
146	Y	Shrub	Shrub	ELLA/HECO/ERNA	HECO/POSE	M	ML
147	Y	Grass	Grass	HECO/POSE	HECO/POSE	M	M
148	Y	Shrub	Grass	HECO/ERNA/BRTE	HECO/POSE	ML	M
149	Y	Grass	Grass	HECO/POSE	HECO/POSE	M	M
150	Y	Grass	Grass	HECO/POSE	HECO/POSE	M	M
151	Y	Grass	Grass	HECO/POSE	HECO/POSE	M	M
152	Y	Shrub	Shrub	HECO/POSE/ERNA	HECO/POSE	M	M
153	Y	Grass	Grass	HECO/POSE	HECO/POSE	M	M
154	Y	Grass	Grass	HECO/POSE	HECO/POSE	M	M
155	Y	Grass	Shrub	HECO/POSE	HECO/BRTE	M	ML
156	Y	Shrub	Shrub	HECO/ELLA/ERNA	POSE/BRTE	ML	L
157	Y	Grass	Grass	HECO/POSE	HECO/POSE	M	M
158	N	Shrub	Grass	PUTR/HECO	HECO/POSE	M	ML
159	N	Shrub	Grass	PUTR/HECO	HECO/POSE	M	M
160	N	Shrub	Grass	PUTR/HECO/ERNA	HECO/PSSP/POSE	M	ML
161	N	Shrub	Grass	PUTR/HECO	ELLA/BRTE	M	ML

Table 3: Size and Reproductive Success of Sage Sparrow Territories on the BCA in 2012

Location	Plot	Type	Name	Hectares	Paired?	Fledglings? (#)	Notes
S. Boeing	211	Territory	BCA_1	3.28	Y	N	Observed a pair carrying food and alarm chipping on 7/10-7/12. Saw LOSH attacking male on 7/12. No sign of birds on next visit.
S. Boeing	211, 220	Territory	BCA_2	4.71	Y	Y (1)	No female observed, however a male was observed feeding 1 older fledgling on 7/18. Saw LOSH attacking male on 7/18.
S. Boeing	219	Territory	BCA_3	4.03	Y	Y (2)	Pair with two fledglings observed on 6/1 and 6/6.
S. Boeing	219, 225	Territory	BCA_4	4.45	N	N	Possible female chip on 6/4, however no other observations of females or fledglings occurred.
S. Boeing	217, 218, 223, 224, 225, 226	Territory	BCA_5	1.59 11.57	Y	N	This male had a unique song. He was first located in the eastern territory on 5/20. He was relocated on 6/11 far to the west. He moved further west on each subsequent visit. Agitated chipping from pair on 5/20. No clear signs of female after 6/11. Observed baby coyote following male around on 6/27.
S. Boeing	219, 220, 225, 226	Territory	BCA_6	7.91	Y	Y (1)	Female first observed on 5/20, observed frequently after 7/2. Male observed feeding one younger fledgling on 7/23 and 7/25.
S. Boeing	219, 220, 226	Territory	BCA_9	4.34	Y	Y (3)	Male initially very hard to locate. Female observed on 6/7, 6/21, and 7/23. A pair with 3 fledglings that flew across 3 territories on 7/23 is most likely this pair.
S. Boeing	218, 219, ?	Unconfirmed	BCA_7	4.69	?	N?	Male heard countersinging with adjacent males several times throughout the season. Only located on 7/12.
S. Boeing	211, 212, ?	Unconfirmed	BCA_10	1.06	?	N?	Male heard countersinging with adjacent males several times throughout the season. Only located on 5/15.
S. Boeing	220, 226, ?	Unconfirmed	BCA_11	3.30	?	N?	Male heard countersinging with adjacent males several times throughout the season. Never located.
S. Boeing	210, ?	Unconfirmed	BCA_12	3.64	?	N?	Male heard countersinging with adjacent males several times throughout the season. Never definatively located.
Doherty	203, 189, ?	Incidental	BCA_8	0.84	N	N	Detected and followed male on 6/14. No sign of male previously, or in any subsequent visits.

Table 4: Juvenile Sage Sparrow Detections on the BCA in 2012. These birds were too old to be assigned to territories

Date	Observation
18-Jul	3 older juveniles observed in a flock of ~ 40 LASP near BCA-5, No sign of adult SAGS
18-Jul	1 older juvenile observed in BCA-3 with 1 LASP juvenile. No sign of adult SAGS
24-Jul	1 older juvenile observed in BCA-6. Male SAGS chased juvenile out of territory. Male observed with much younger fledgling the following day.
26-Jul	1 older juvenile observed in BCA-6. Male observed feeding much younger fledgling the previous day.
26-Jul	1 younger juvenile observed by itself in BCA-11. Joined juvenile flock at corner of territories BCA-6, 9, & 11.
26-Jul	Flock of 3 older juveniles observed in the corner of territories BCA-6, 9, & 11. Male observed singing and foraging nearby, but not actively feeding juveniles. Area is intersection of several territories. SAGS seem to be congregating in this area in late July.

Table 5: Number and location of Sage Sparrow territories 2003-2012 on the BCA.

Number of SAGS territories reported on the BCA in large sagebrush patches					
Year	Area of BCA				TOTAL
	Schoolhouse/McIntyre	Rugg Well/Cowboy	South Boeing	Doherty	
2003	6	2	1	0	9
2006	3	0	4	0	7
2009	2	0	4	0	6
2012	0	0	7 confirmed, 4 unconfirmed	0	7
Notes	This area has been the most intensively surveyed. Cheatgrass increased post-grazing.	Area is encroached by juniper.	Most sagebrush in South Boeing burned in 2008, fragmenting remaining sagebrush stands. Also, the area is fairly inaccessable, and may not have been well surveyed in 2003-2009.	Area is fairly inaccessable, and may not have been well surveyed in 2003-2009.	

Figures

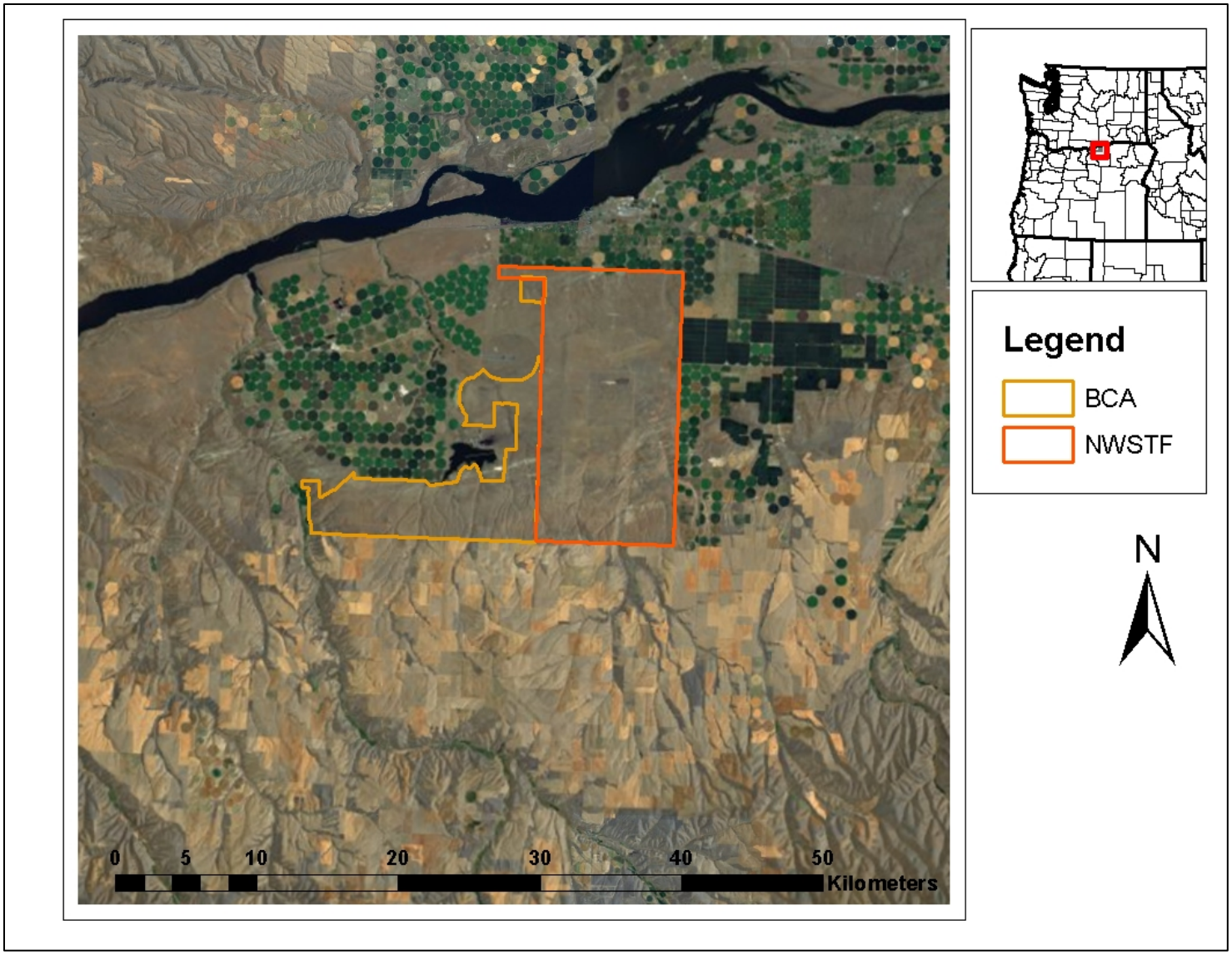


Figure 1: Location of the BCA and NWSTF

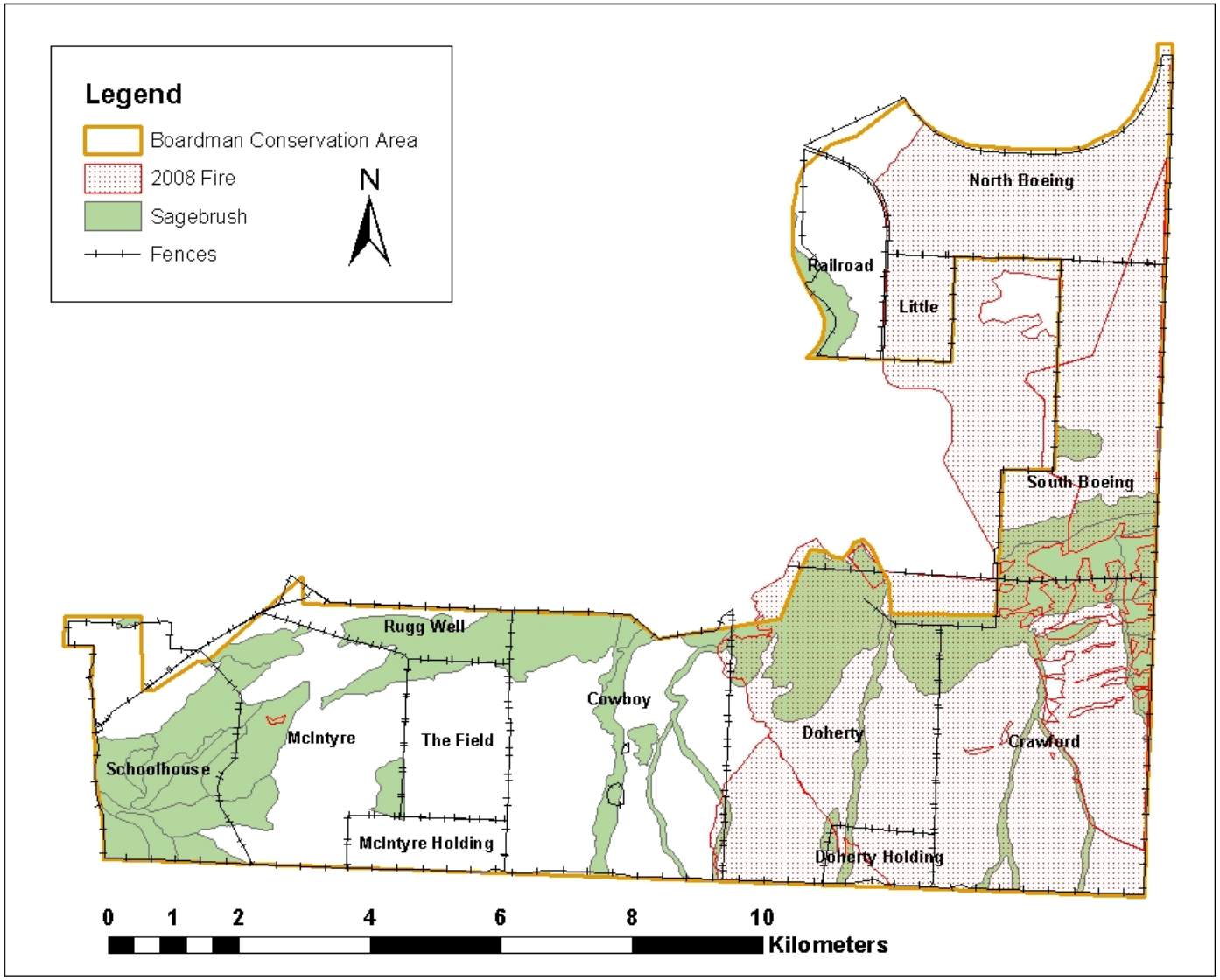


Figure 2: The extent to which the 2008 wildfire burned sagebrush habitat on the BCA

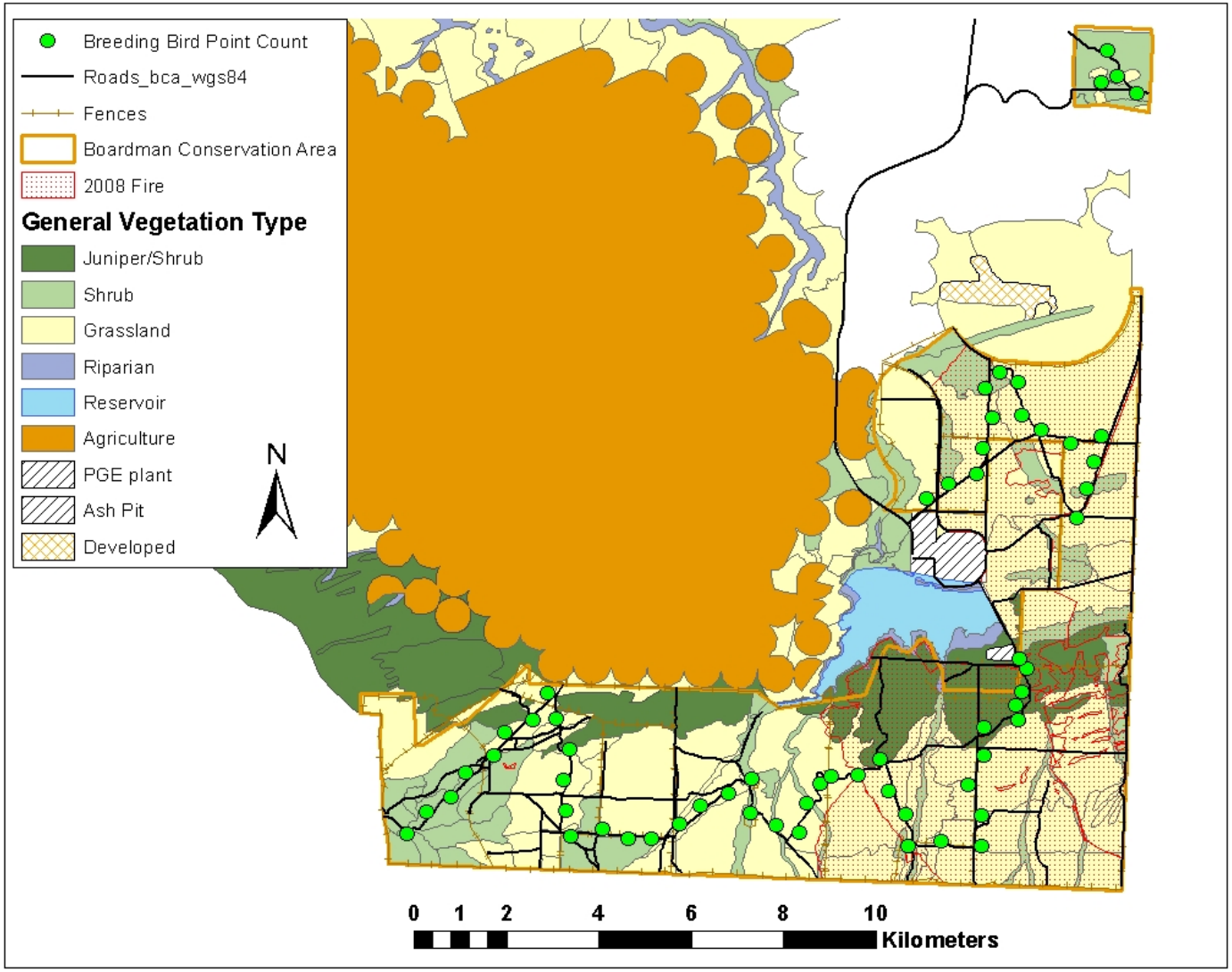


Figure 3: Locations of breeding bird point count stations on the BCA. Shows the general vegetation type of all the stations based on the 2002 vegetation map, as well as station locations in regards to the 2008 wildfire. In 2012 there was less shrub habitats than displayed due to the 2008 wildfire, as well as restoration actions in areas dominated by green or gray rabbitbrush..

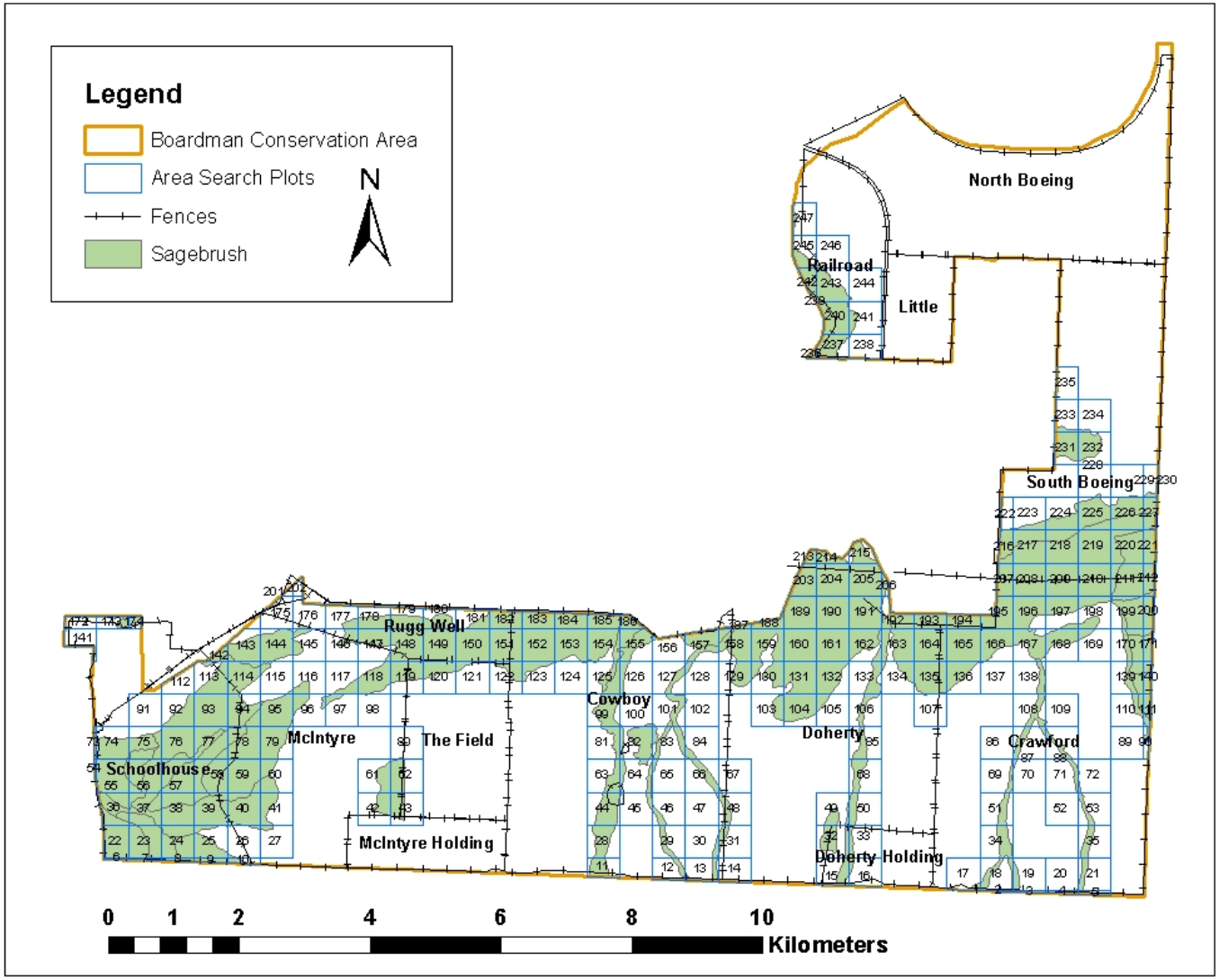


Figure 4: 2012 sage sparrow area search plots

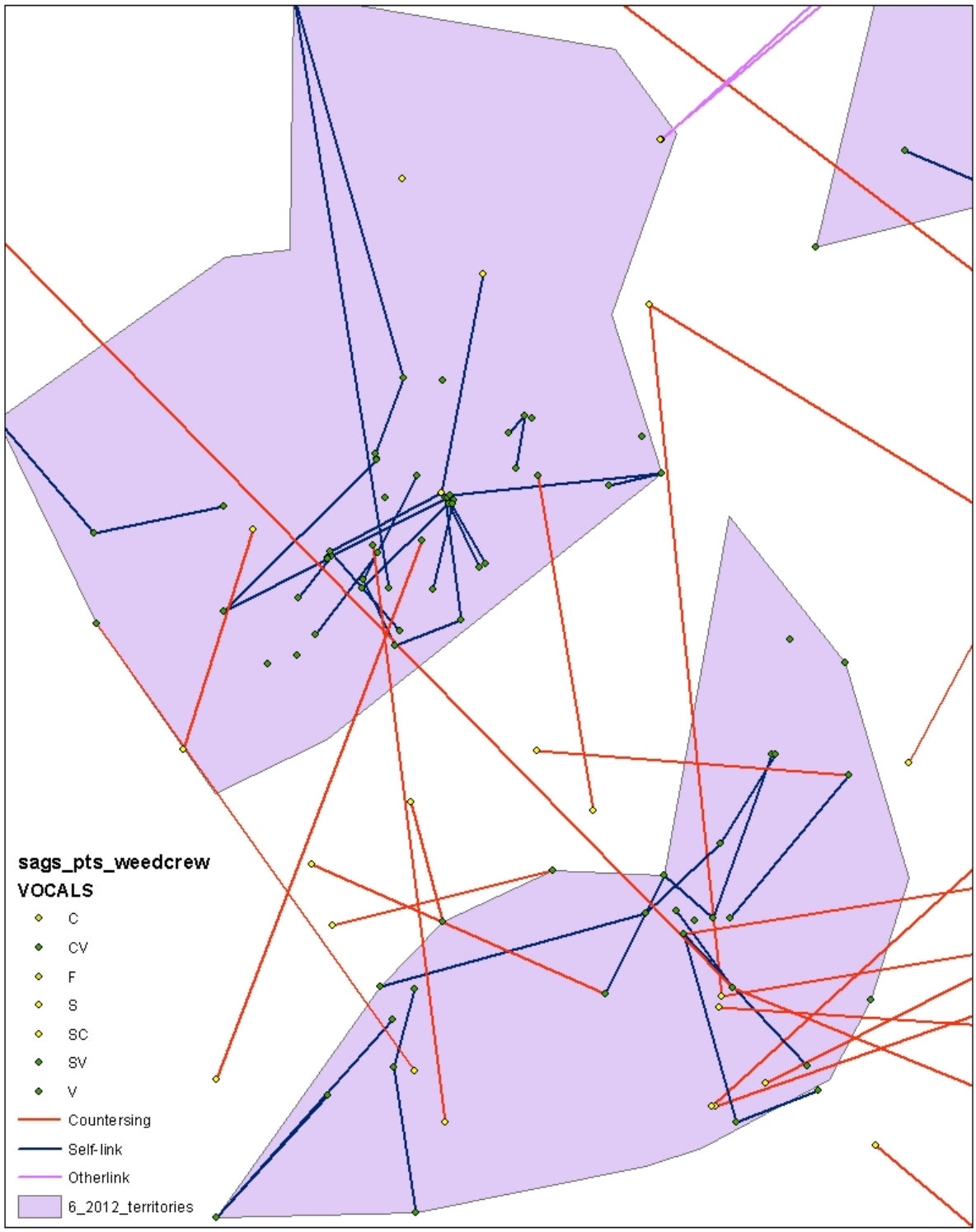


Figure 5: Example of typical spotmapping data. Movements of individual birds are shown in blue lines. Countersinging events are shown in red lines. Green dots are used for visual observations at precise locations, and yellow dots are used for non-visual observations, and are estimated locations. Existing territories were modified based on the actual locations, self-linking bird movements and countersinging.

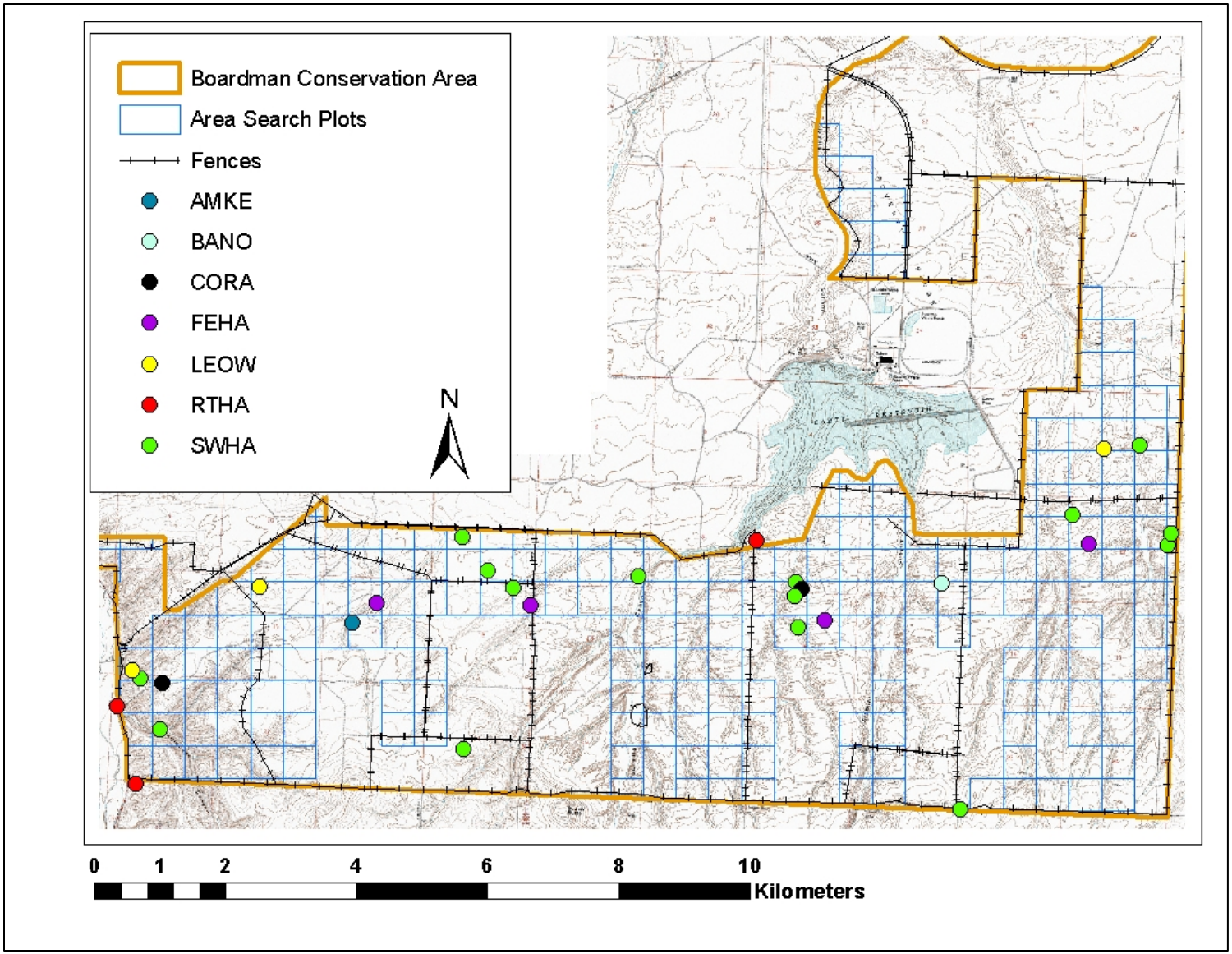


Figure 6. Raptor nest locations on the BCA in 2012.

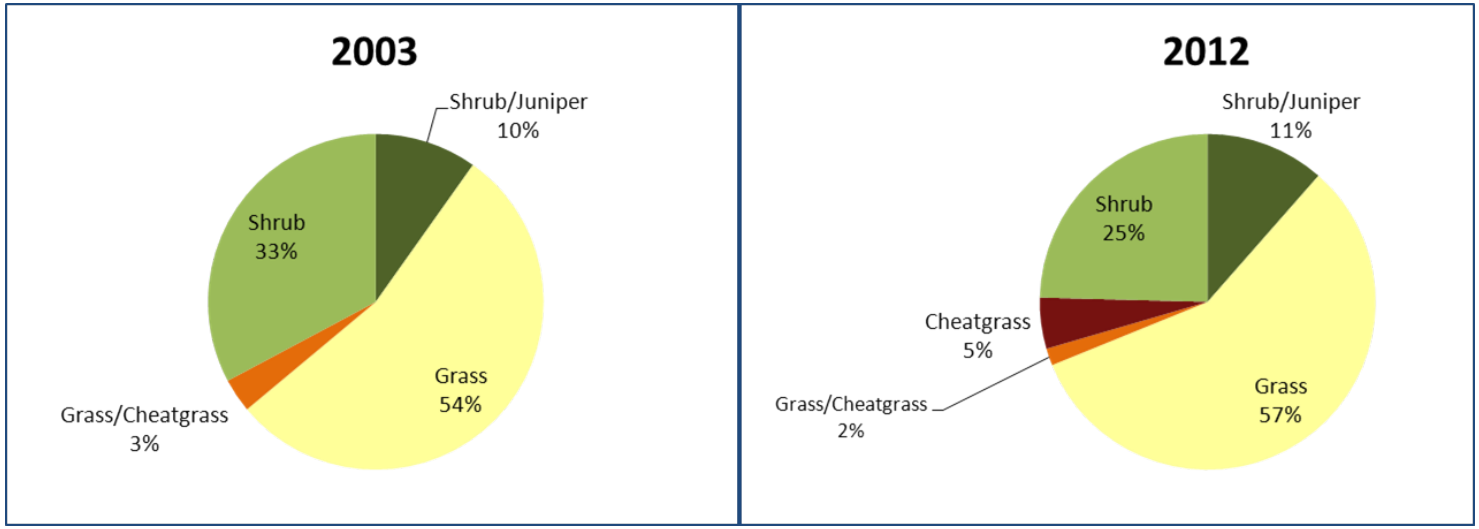


Figure 7: Changes in general vegetation between 2003 and 2012.

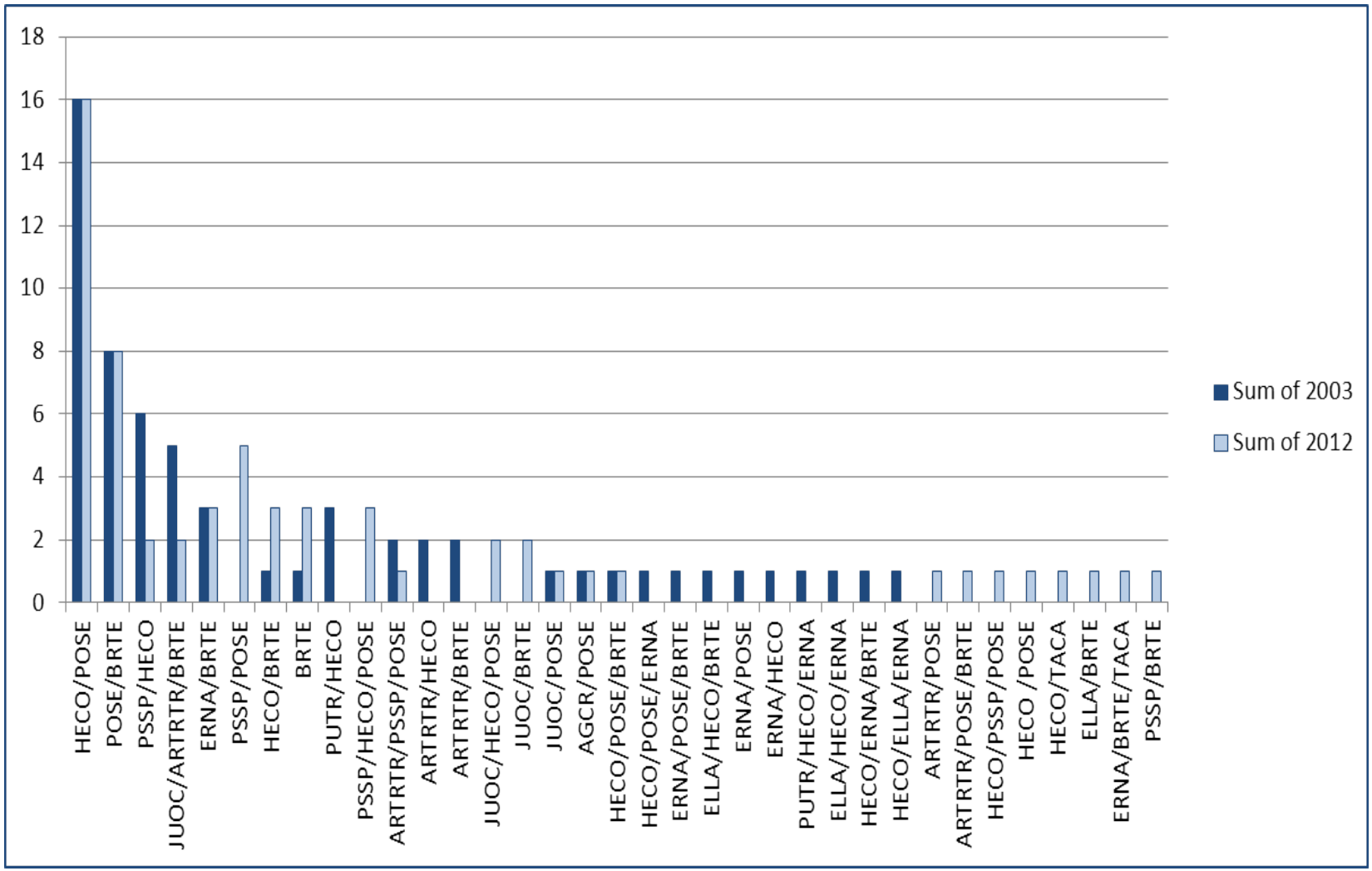


Figure 8: Classification of point count stations in 2003 and 2012. This chart shows the number of stations with each type of dominant vegetation in both years.

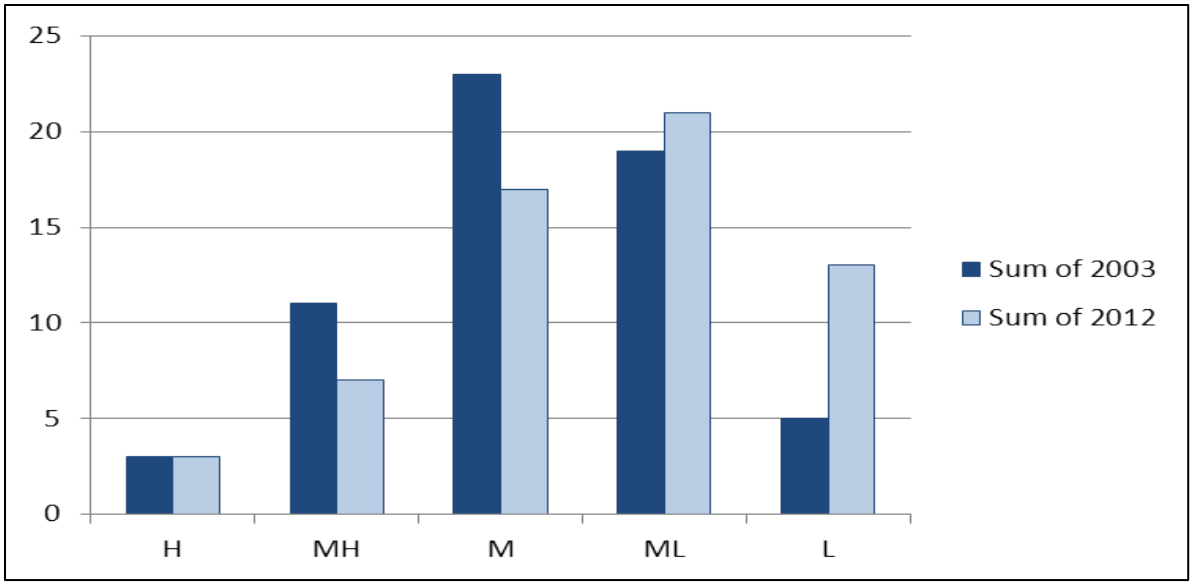
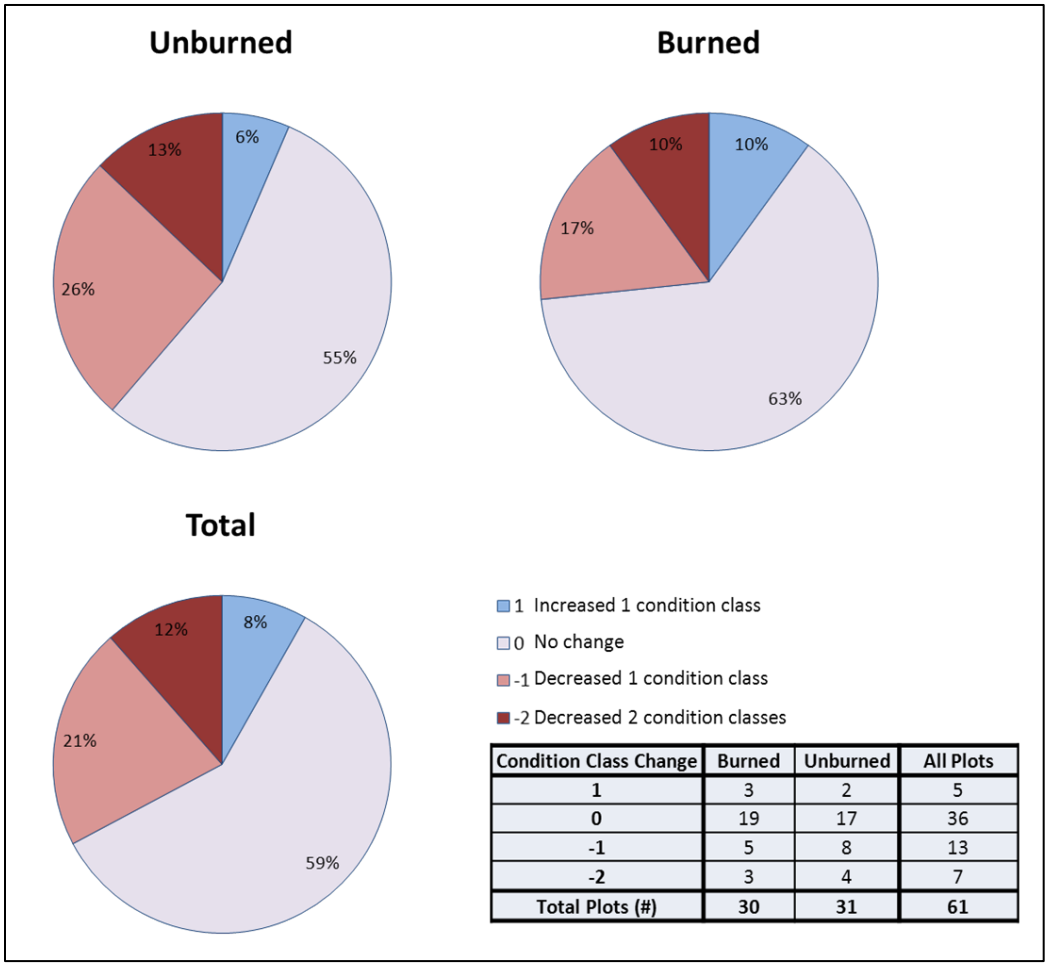


Figure 9: Number of stations in each condition class in 2003 and 2012.



Condition Class Change	Burned	Unburned	All Plots
1	3	2	5
0	19	17	36
-1	5	8	13
-2	3	4	7
Total Plots (#)	30	31	61

Figure 10: Changes in condition class between 2003 and 2012.

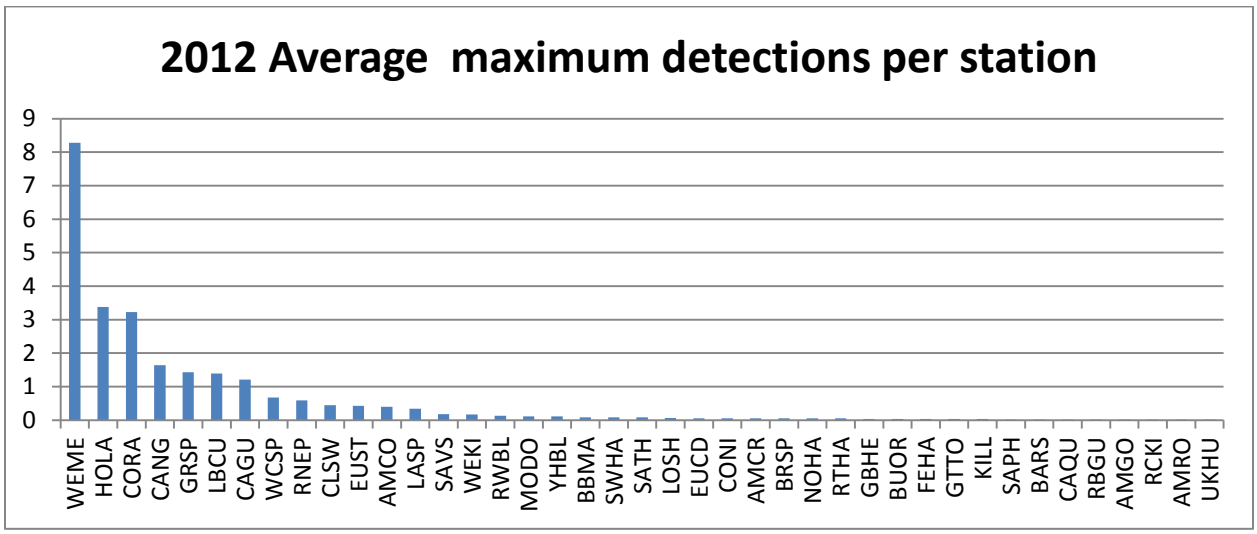


Figure 11a. Average maximum detections per station. Shows the average of the highest number of detections between the two visits at all stations for each species.

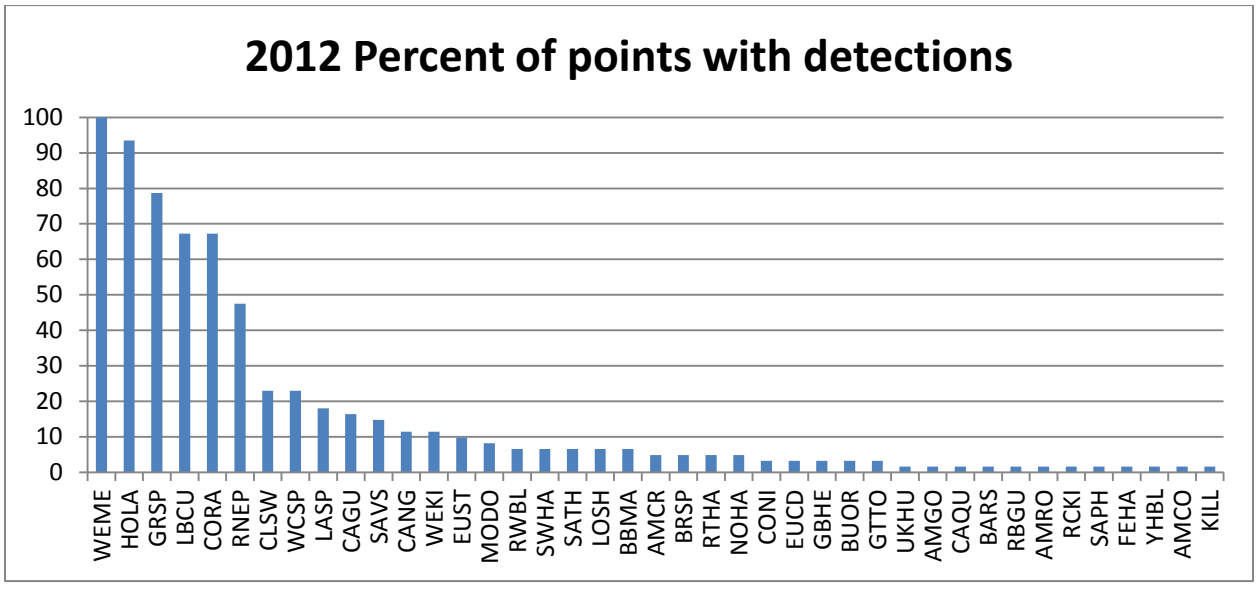


Figure 11b. Percentage of points with at least one detection on either visit for each species.

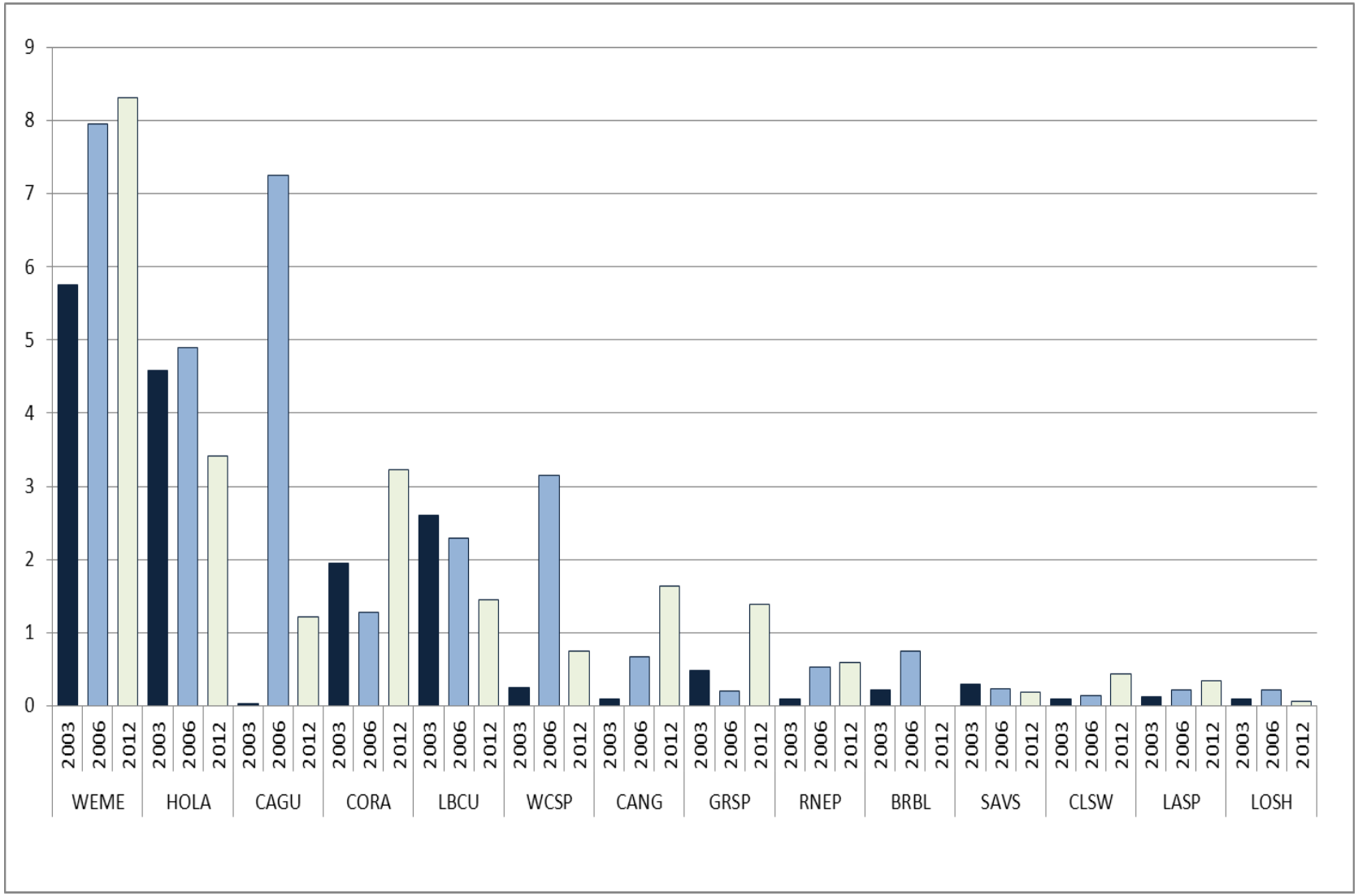


Figure 12: Average maximum detections per station for selected species in all survey years. Shows the average of the highest number of detections between the two visits at all stations for each of the most abundant species in all survey years.

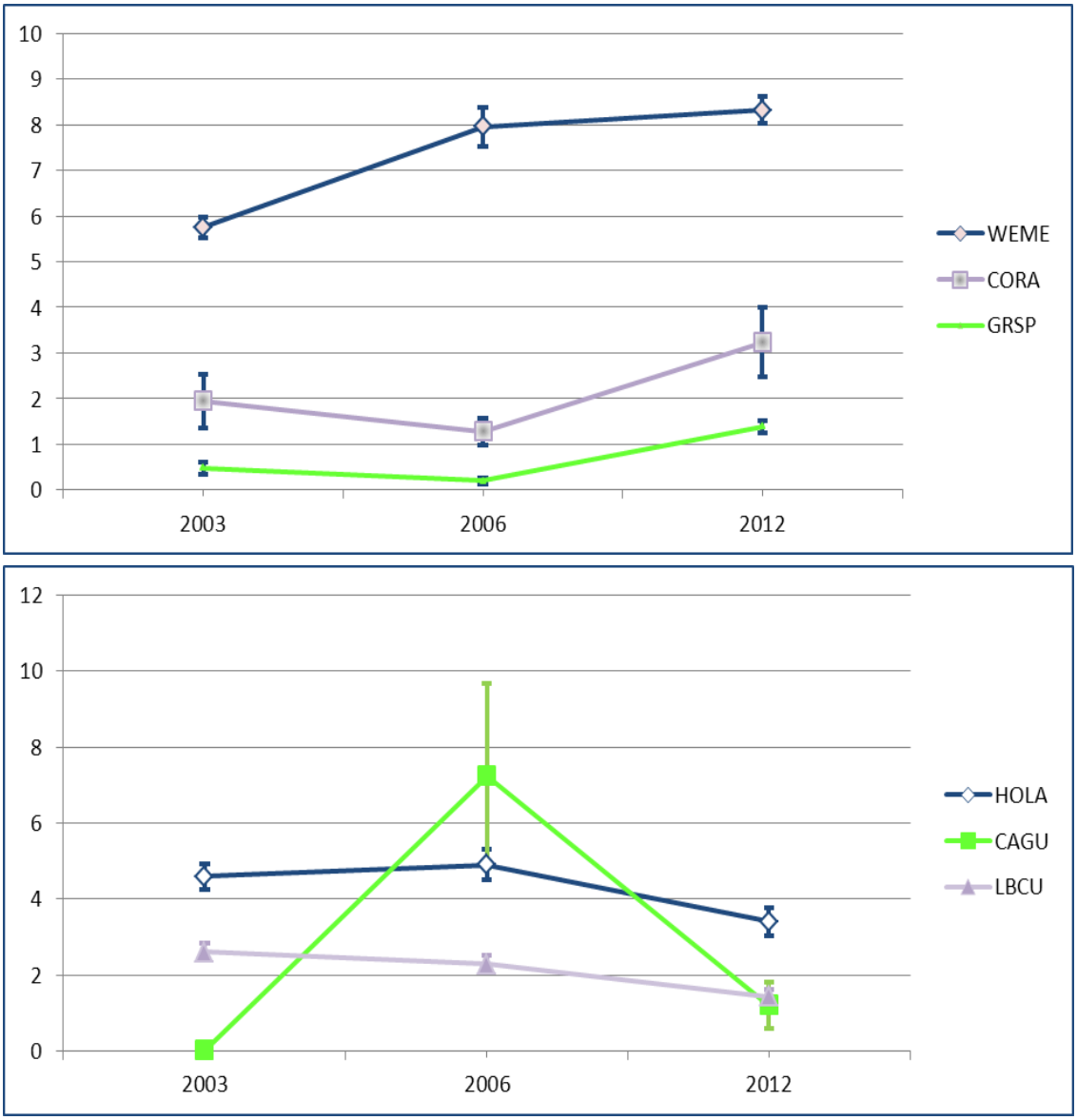


Figure 13: Changes in abundance for selected species. Shows the average of the highest number of detections between the two visits at all stations for each of the most abundant species in all survey years.

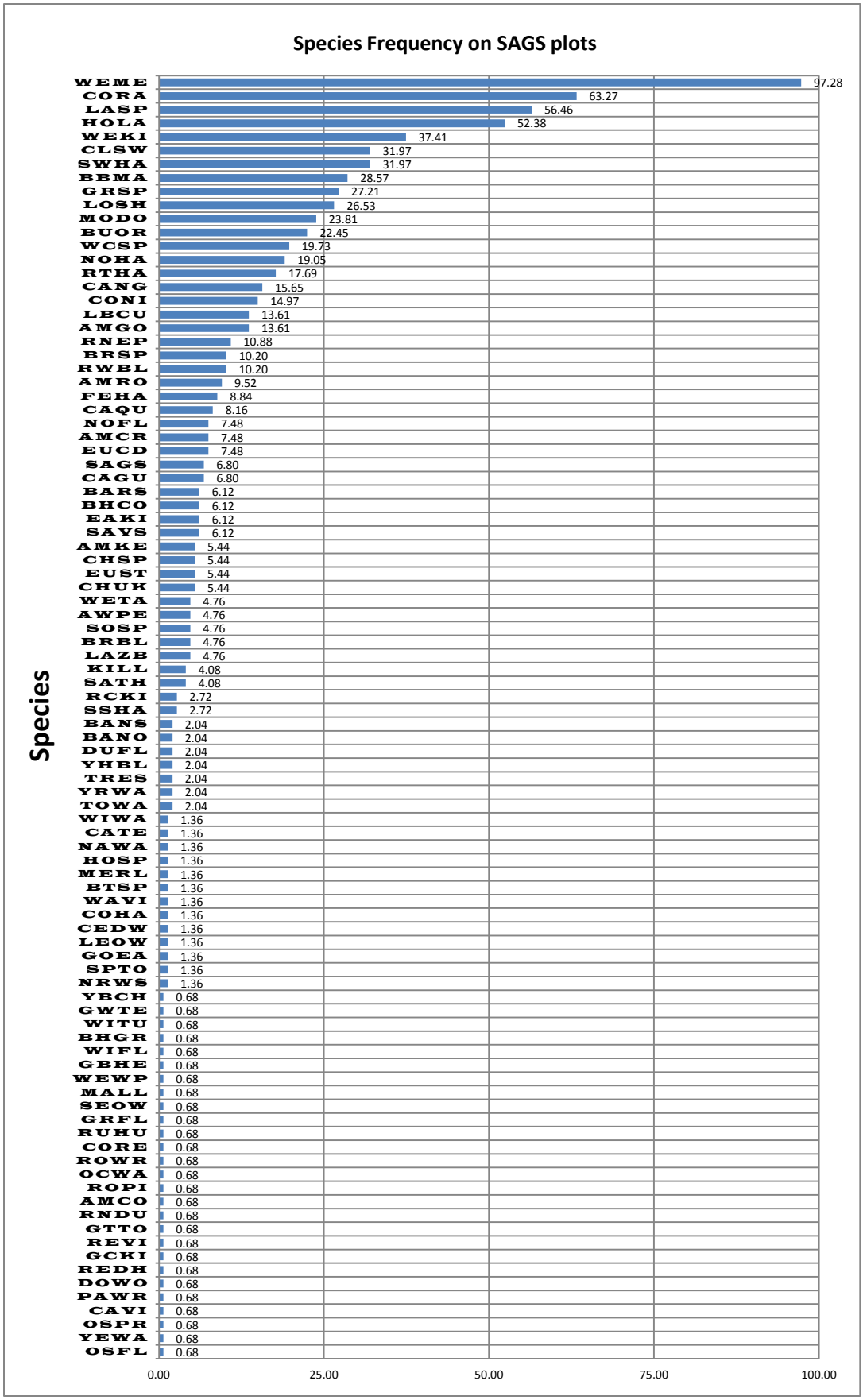


Figure 14. Species Frequency on SAGS area search plots. (% of plots on which the species was detected)

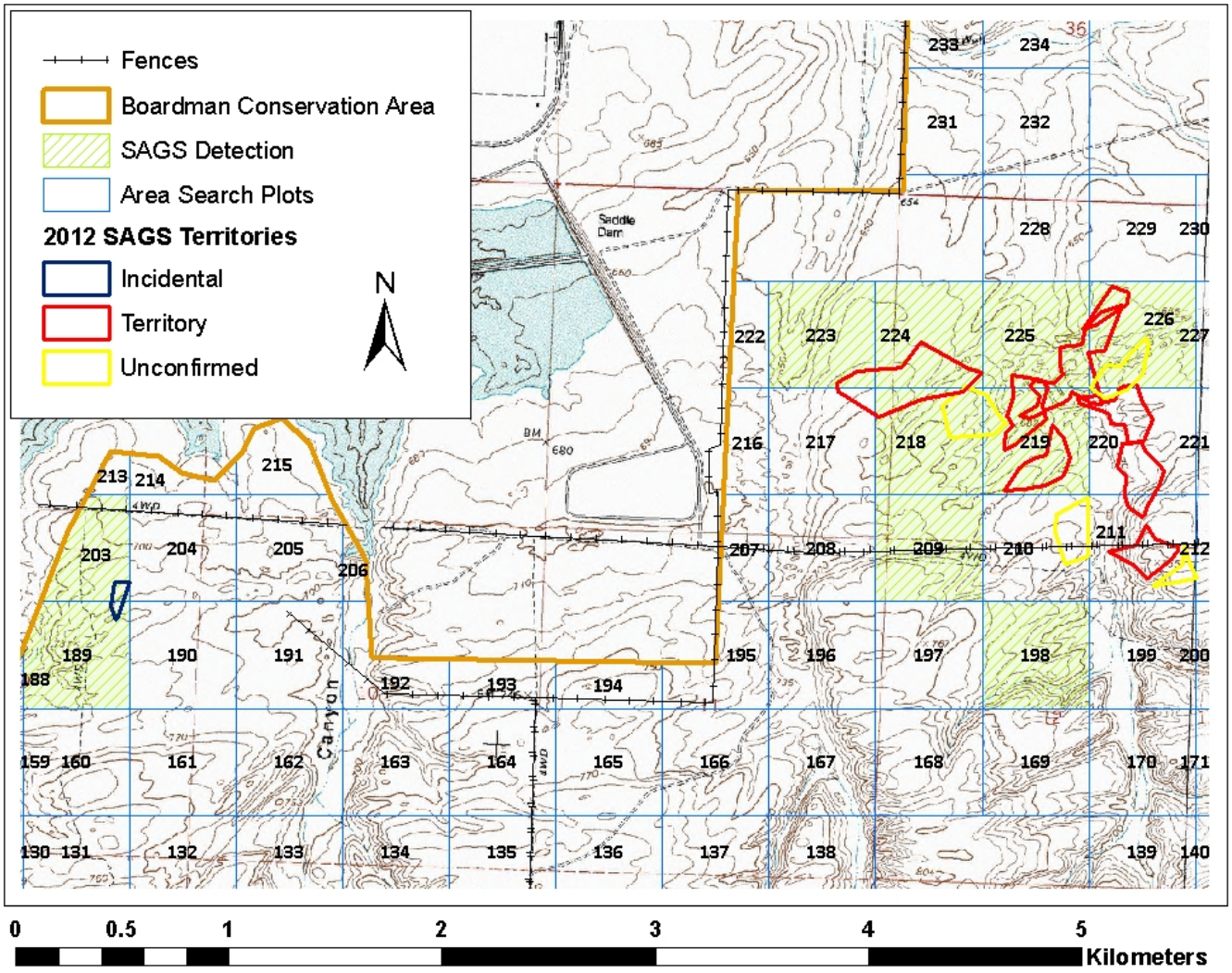


Figure 15: Overview of sage sparrow detections on area search plots in 2012

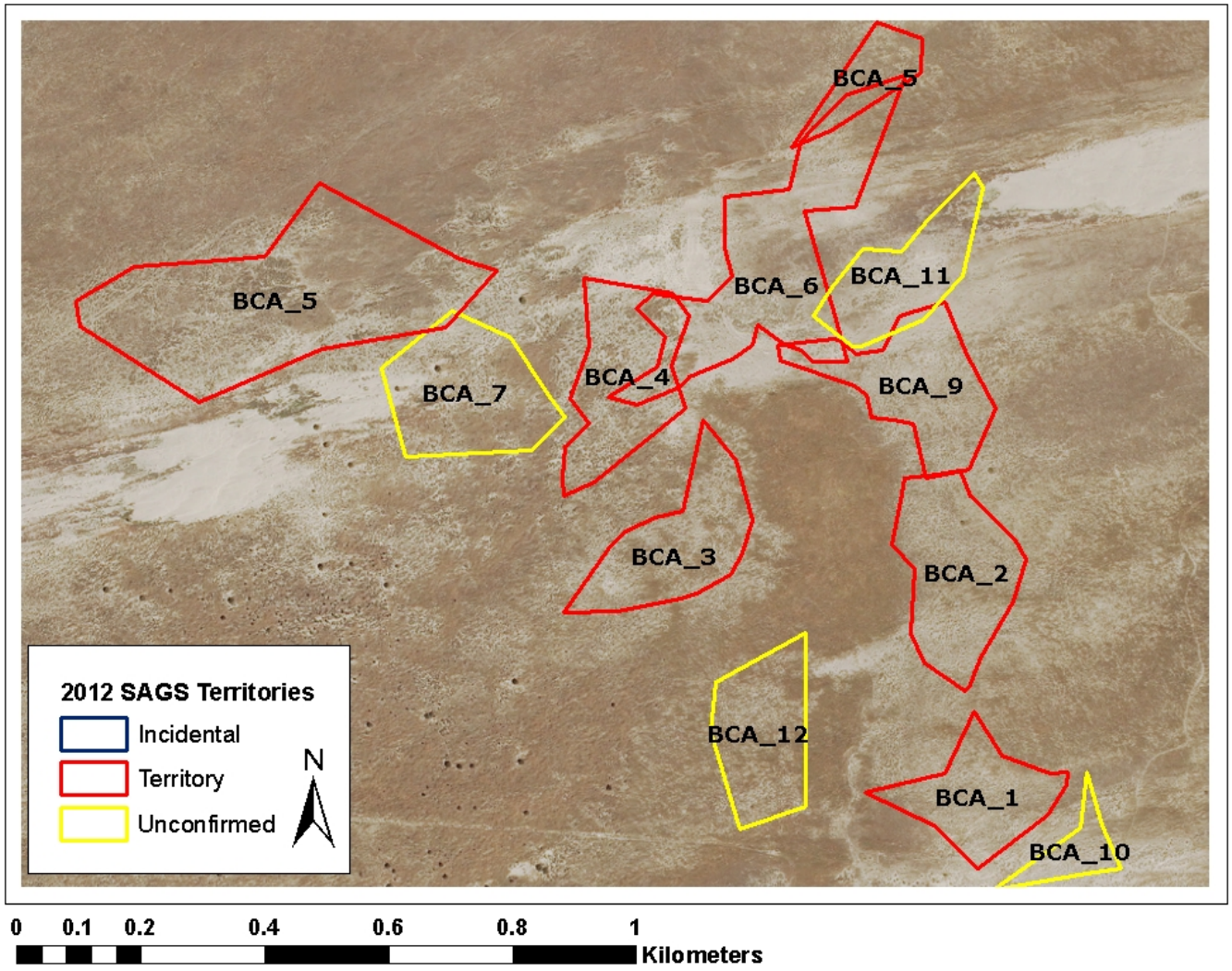


Figure 16: Sage sparrow territories in South Boeing pasture. In the imagery, the whitish areas are sand dunes, the dark spots are juniper trees, the speckled areas are sagebrush, and the solid dark brown areas are cheatgrass dominated grasslands.

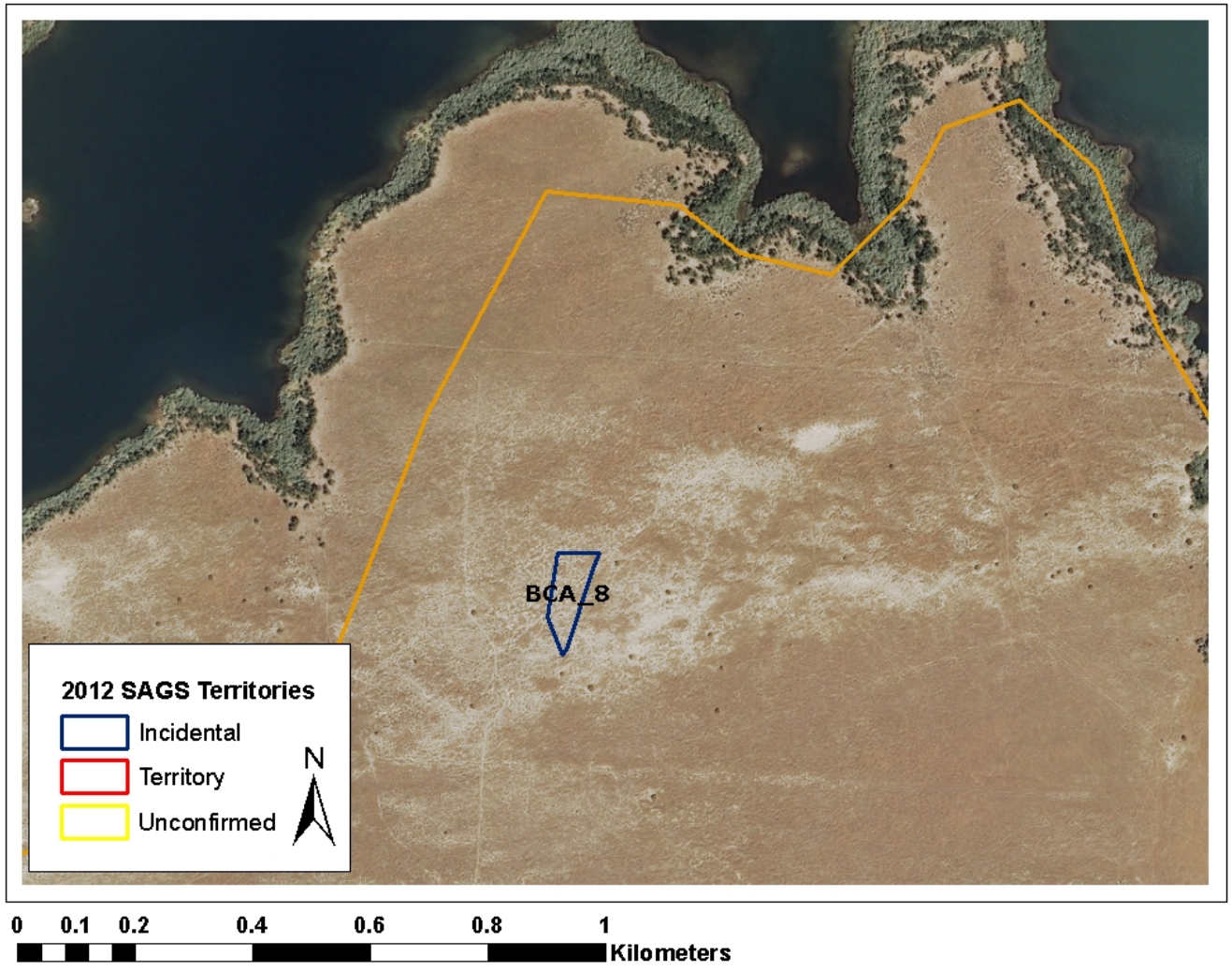
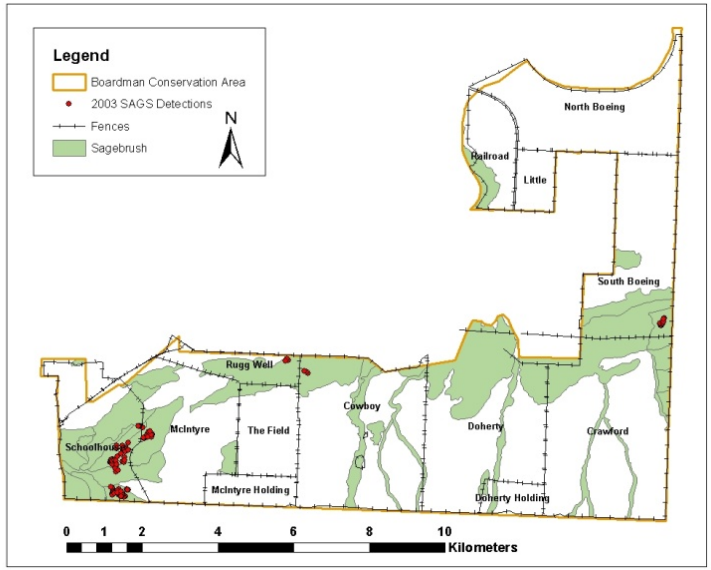
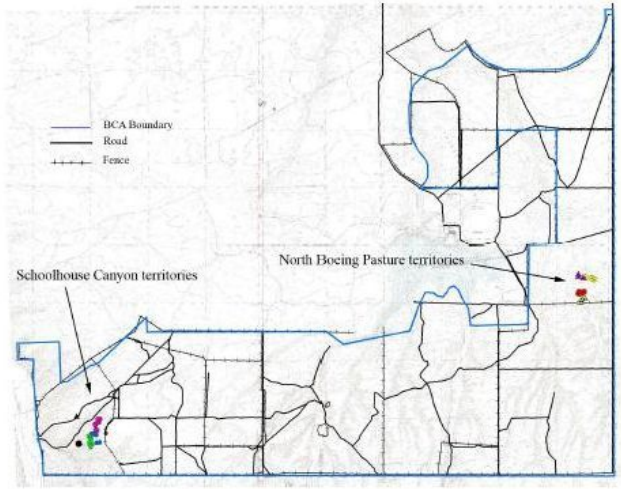
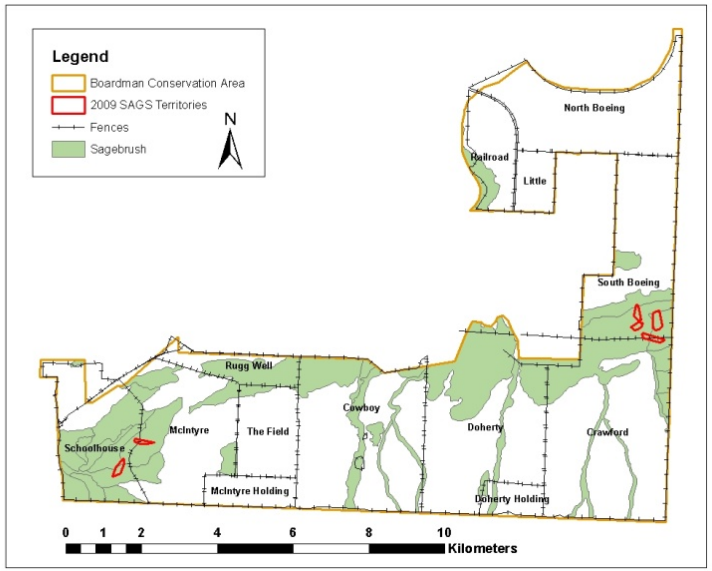


Figure 17: Sage sparrow incidental detection in Doherty pasture





Overview of the distribution of sage sparrow territories on the Boardman Conservation Area, Morrow County, Oregon. Each colored symbol represents points in one of seven confirmed territories; different black shapes represent incidental sightings of sage sparrows, likely passage migrants.



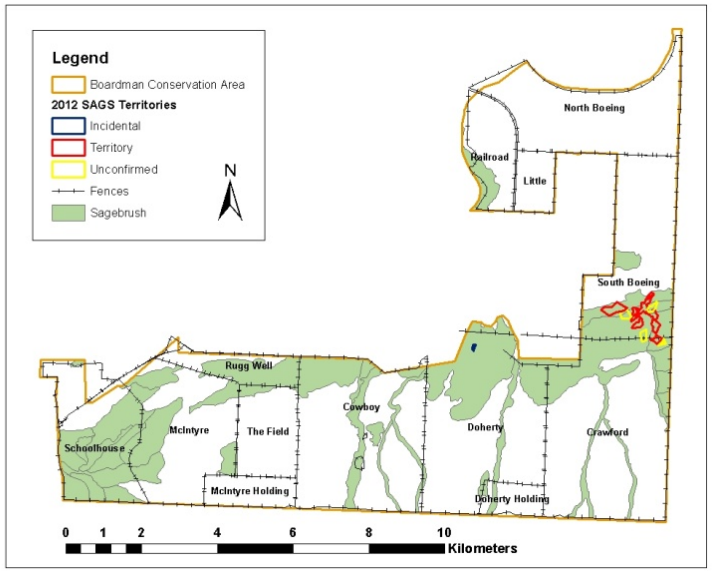


Figure 18: Overview of the historic and current distribution of sage sparrow territories on the BCA

Literature Cited

Borror Laboratory of Bioacoustics. Ohio State University. Bird Sounds from the Borror Laboratory of Bioacoustics. drc.ohiolink.edu/handle/2374.OX/30658 Accessed 2012.

Brennan, L. A. and W. P. Kuvlesky. 2005. North American grassland birds: An unfolding conservation crisis? Journal of Wildlife Management **69**:1-13.

Brotons, L., M. Magrans, L. Ferrus, and J. Nadal. 1998. Direct and indirect effects of pollution on the foraging behaviour of forest passerines during the breeding season. Canadian Journal of Zoology-Revue Canadienne De Zoologie **76**:556-565.

Bryan, A. L., W. A. Hopkins, J. A. Baionno, and B. P. Jackson. 2003. Maternal transfer of contaminants to eggs in common grackles (Quiscalus quiscala) nesting on coal fly ash basins. Archives of Environmental Contamination and Toxicology **45**:273-277.

Bryan, A. L., W. A. Hopkins, J. H. Parikh, B. P. Jackson, and J. M. Unrine. 2012. Coal fly ash basins as an attractive nuisance to birds: Parental provisioning exposes nestlings to harmful trace elements. Environmental Pollution **161**:170-177.

David Evans and Associates (DEA). 2004. Multi-Species Candidate Conservation Agreement with Assurances. Boardman Area. Covers the Washington ground squirrel, ferruginous hawk, loggerhead shrike and the sage sparrow. Signatories are Threemile Canyon Farms, The Nature Conservancy, Portland General Electric Company, U.S. Fish and Wildlife Service and the Oregon Department of Fish and Wildlife. February 2004.

Davies, K. W., C. S. Boyd, J. L. Beck, J. D. Bates, T. J. Svejcar, and M. A. Gregg. 2011. Saving the sagebrush sea: An ecosystem conservation plan for big sagebrush plant communities. Biological Conservation **144**:2573-2584.

Duberstein, C. A., M. A. Simmons, M. R. Sackschewsky, and J. M. Becker. 2008. Development of a Habitat Suitability Index Model for the Sage Sparrow on the Hanford Site. Page 25 *in* P. N. N. Laboratory and D. o. Energy, editors., Richland, WA.

Earnst, S. L., H. L. Newsome, W. L. LaFramboise, and N. LaFramboise. 2009. Avian response to wildfire in interior columbia basin shrubsteppe. Condor **111**:370-376.

Elseroad, A.C. 2002. Plant communities of the Boardman Study Area. Unpublished report. The Nature Conservancy, Portland, Oregon.

Elseroad, A.C., Fink, K. and Rudd N. 2011. Boardman Conservation Area: 2011 vegetation monitoring report: Changes in vegetation three years following wildfire. Unpublished report. The Nature Conservancy, Portland, Oregon.

Fesenmyer, K. A. and S. T. Knick. 2011. Seasonal Movements and Environmental Triggers to Fall Migration of Sage Sparrows. Wilson Journal of Ornithology **123**:803-807.

Fleischner, T. L. 1994. Ecological costs of livestock grazing in western north-america. Conservation Biology **8**:629-644.

Gabrielson, I. N., and S. G. Jewett. 1940. Birds of Oregon. Oregon State College, Corvallis, Oregon.

Gorriz, A., S. Llacuna, M. Durfort, and J. Nadal. 1994. A study of the ciliar tracheal epithelium on passerine birds and small mammals subjected to air-pollution - ultrastructural-study. Archives of Environmental Contamination and Toxicology **27**:137-142.

Gorriz, A., S. Llacuna, M. Riera, and J. Nadal. 1996. Effects of air pollution on hematological and plasma parameters in Apodemus sylvaticus and Mus musculus. Archives of Environmental Contamination and Toxicology **31**:153-158.

Harry, O. 2003. - Ecotoxicology Of Selenium. in Hoffman, D. J., B. A. Rattner, G. A. Burton, and J. Cairns.(editors) Handbook of ecotoxicology. Lewis Publishers, Boca Raton, FL.

Hartway, C. and L. S. Mills. 2012. A Meta-Analysis of the Effects of Common Management Actions on the Nest Success of North American Birds. Conservation Biology **26**:657-666.

Hawlena, D., D. Saltz, Z. Abramsky, and A. Bouskila. 2010. Ecological Trap for Desert Lizards Caused by Anthropogenic Changes in Habitat Structure that Favor Predator Activity. Conservation Biology **24**:803-809.

Holmes, A. L., and G. R. Geupel. 1998. Avian population studies at Naval Weapons Systems Training Facility Boardman Oregon. Unpublished report to the Department of Navy and the Oregon Department of Fish and Wildlife. Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach CA 94970.

Holmes, J.A. and M.J. Johnson (2005, January 11). Sage Sparrow (*Amphispiza belli*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/sagesparrow.pdf [2012].

Humple, L. H. and A. L. Holmes. 2001. Fire induced changes in sagebrush steppe habitat and bird populations at Naval Weapons Systems Training Facility Boardman, Oregon. PRBO contribution #969. Point Reyes Bird Observatory, Stinson Beach, CA.

Kagan, J. S., R. Morgan, and K. Blakely. 2000. Umatilla and Willow Creek Basin Assessment for Shrub Steppe, Grasslands, and Riparian Wildlife Habitats. EPA Regional Geographic Initiative Final Report.

Kim, D. H., F. Chavez-Ramirez, and R. D. Slack. 2003. Effects of artificial perches and interspecific interactions on patch use by wintering raptors. Canadian Journal of Zoology-Revue Canadienne De Zoologie **81**:2038-2047.

Knick, S. T., D. S. Dobkin, J. T. Rotenberry, M. A. Schroeder, W. M. Vander Haegen, and C. van Riper. 2003. Teetering on the edge or too late? Conservation and research issues for avifauna of sagebrush habitats. Condor **105**:611-634.

Knick, S. T. and J. T. Rotenberry. 1995. Landscape characteristics of fragmented shrubsteppe habitats and breeding passerine birds. Conservation Biology **9**:1059-1071.

Knick, S. T. and J. T. Rotenberry. 1999. Spatial distribution of breeding passerine bird habitats in a shrubsteppe region of southwestern Idaho. Pages 104-111 *in* P. D. Vickery and J. R. Herkert, editors. Ecology and Conservation of Grassland Birds of the Western Hemisphere.

Knick, S. T. and J. T. Rotenberry. 2000. Ghosts of habitats past: Contribution of landscape change to current habitats used by shrubland birds. Ecology **81**:220-227.

Knick, S. T. and J. T. Rotenberry. 2002. Effects of habitat fragmentation on passerine birds breeding in Intermountain shrubsteppe. Studies in Avian Biology. Effects of Habitat Fragmentation on Birds in Western Landscapes: Contrasts with Paradigms from the Eastern United States:130-140.

Leu, M. (unpublished data). SAGESTEP bird monitoring project. (for project info see http://www.sagestep.org/about_the_project/birds_insects.html)

Llacuna, S., A. Gorriz, C. Sanpera, and J. Nadal. 1995. Metal accumulation in 3 species of passerine birds (emberiza-cia, paras-major, and turdus-merula) subjected to air-pollution from a coal-fired power-plant. Archives of Environmental Contamination and Toxicology **28**:298-303.

Macaulay Library. Cornell Lab of Ornithology. macaulaylibrary.org. accessed 2012.

Manzer, D. L. and S. J. Hannon. 2005. Relating grouse nest success and corvid density to habitat: A multi-scale approach. Journal of Wildlife Management **69**:110-123.

Meunier, F. D., C. Verheyden, and P. Jouventin. 2000. Use of roadsides by diurnal raptors in agricultural landscapes. Biological Conservation **92**:291-298.

Misenhelter, M. D. and J. T. Rotenberry. 2000. Choices and consequences of habitat occupancy and nest site selection in sage sparrows. Ecology **81**:2892-2901.

Moore, R. P. 2006. 2006 Sage Sparrow Surveys and Breeding Season Point Counts, Boardman Conservation Area, Boardman, Oregon. Report to the Nature Conservancy. 41 pp.

Morgan, M. R., C. Norment, and M. C. Runge. 2010. Evaluation of a reproductive index for estimating productivity of grassland breeding birds. Auk **127**:86-93.

Nelson, L. 2003. Boardman Conservation Area Management Plan. Unpublished report. The Nature Conservancy, Portland, Oregon. 225pp.

Nelson, L. 2007. Boardman Grasslands Conservation Action Plan. Unpublished report. The Nature Conservancy, Portland, Oregon. 56pp.

Noson, A. C., R. A. Schmitz, and R. F. Miller. 2006. Influence of fire and Juniper encroachment on birds in high-elevation sagebrush steppe. Western North American Naturalist **66**:343-353.

Ohlendorf, H. 2003. Ecotoxicology Of Selenium. in Hoffman, D. J., B. A. Rattner, G. A. Burton, and J. Cairns.(editors) Handbook of ecotoxicology. Lewis Publishers, Boca Raton, FL..

Omdal, M. 2003. Breeding Bird Survey Report, Boardman Conservation Area, Boardman, Oregon. Report to the Nature Conservancy. 51 pp.

Peterjohn, B. G. and J. R. Sauer. 1999. Population status of North American grassland birds from the North American Breeding Bird Survey, 1966-1996. Pages 27-44 *in* P. D. Vickery and J. R. Herkert, editors. Ecology and Conservation of Grassland Birds of the Western Hemisphere.

Petersen, K. L. and L. B. Best. 1987. Territory dynamics in a sage sparrow population - are shifts in site use adaptive. Behavioral Ecology and Sociobiology **21**:351-358.

Prather, P. R. and T. A. Messmer. 2010. Raptor and Corvid Response to Power Distribution Line Perch Deterrents in Utah. Journal of Wildlife Management **74**:796-800.

RNP (Renewable Northwest Project). www.rnp.org/project_map. Accessed 2012.

Ralph, C.J., G.R. Geupel, P. Pyle, T.E. Martin, & D.F. Desante. 1993. Field Methods for Monitoring Landbirds. USDA Forest Service Publication, PSW-GTR 144, Albany, CA.

Reed, J. M. 1985. A comparison of the “flush” and spot-map methods for estimating the size of Vesper Sparrow territories. J. Field Ornith. 56:131-137.

Reinkensmeyer, D. P., R. F. Miller, R. G. Anthony, and V. E. Marr. 2007. Avian community structure along a mountain big sagebrush successional gradient. Journal of Wildlife Management **71**:1057-1066.

Reynolds, T. D. 1979. Impact of loggerhead shrikes on nesting birds in a sagebrush environment. Auk **96**:798-800.

Reynolds, T. D. 1981. Nesting of the sage thrasher, sage sparrow, and brewers sparrow in southeastern idaho. Condor **83**:61-64.

Rich, T. 1981. Microgeographic variation in the song of the sage sparrow. Condor **83**:113-119.

Rivers, J. W., D. P. Althoff, P. S. Gipson, and J. S. Pontius. 2003. Evaluation of a reproductive index to estimate dickcissel reproductive success. Journal of Wildlife Management **67**:136-143.

Robinson 2009. 2009 Sage Sparrow Surveys, Boardman Conservation Area, Boardman, Oregon. Report to the Nature Conservancy. 12 pp.

Rotenberry, J. T. and S. T. Knick. 1999. Multiscale habitat associations of the Sage Sparrow: Implications for conservation biology. Pages 95-103 *in* P. D. Vickery and J. R. Herkert, editors. Ecology and Conservation of Grassland Birds of the Western Hemisphere.

Rotenberry, J. T. and J. A. Wiens. 1989. Reproductive-biology of shrubsteppe passerine birds - geographical and temporal variation in clutch size, brood size, and fledging success. Condor **91**:1-14.

Rotenberry, J. T. and J. A. Wiens. 1991. Weather and reproductive variation in shrubsteppe sparrows - a hierarchical analysis. Ecology **72:**1325-1335.

Rotenberry, J. T. and J. A. Wiens. 2009. Habitat relations of shrubsteppe birds: a 20-year retrospective. Condor **111**:401-413.

Saldiva, P. H. N. and G. M. Bohm. 1998. Animal indicators of adverse effects associated with air pollution. Ecosystem Health **4**:230-235.

Sauer, J. R., J. E. Hines, G. Gough, I. Thomas, and B. G. Peterjohn. 1997. The North American Breeding Bird Survey: Results and Analysis. Version 96.4. USGS Patuxent Wildlife Research Center, Laurel, MD.

Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2011. The North American Breeding Bird Survey, Results and Analysis 1966 - 2010. Version 12.07.2011 USGS Patuxent Wildlife Research Center, Laurel, MD

Sheffield, L. M., J. R. Crait, W. D. Edge, and G. M. Wang. 2001. Response of American kestrels and gray-tailed voles to vegetation height and supplemental perches. Canadian Journal of Zoology-Revue Canadienne De Zoologie **79**:380-385.

Stahlecker, D. W. 1978. Effect of a new transmission-line on wintering prairie raptors. Condor **80**:444-446.

USDON (U.S. Dept. of Navy). 2012. Naval Weapons SystemsTraining Facility BoardmanDraft Environmental Impact Statement.

Vander Haegen, W. M. 2007. Fragmention by agriculture influences reproductive success of birds in a shrubsteppe landscape. Ecological Applications **17**:934-947.

Vander Haegen, W. M., F. C. Dobler, and D. J. Pierce. 2000. Shrubsteppe bird response to habitat and landscape variables in eastern Washington, USA. Conservation Biology **14**:1145-1160.

Vander Haegen, W. M. and B. Walker. 1999. Parasitism by Brown-headed Cowbirds in the shrubsteppe of eastern Washington.

Vickery, P. D., P. L. Tubaro, J. M. C. da Silva, B. G. Peterjohn, J. R. Herkert, and R. B. Cavalcanti. 1999. Conservation of grassland birds in the Western Hemisphere. Pages 2-26 *in* P. D. Vickery and J. R. Herkert, editors. Ecology and Conservation of Grassland Birds of the Western Hemisphere.

Wiens, J. A. 1982. Song pattern variation in the sage sparrow (amphispiza-belli) - dialects or epiphenomena. Auk **99**:208-229.

Wiens, J. A., J. T. Rotenberry, and B. Vanhorne. 1985. Territory size variations in shrubsteppe birds. Auk **102**:500-505.

Winter, B. M. and L. B. Best. 1985. Effect of prescribed burning on placement of sage sparrow nests. Condor **87**:294-295.

Wolff, J. O., T. Fox, R. R. Skillen, and G. M. Wang. 1999. The effects of supplemental perch sites on avian predation and demography of vole populations. Canadian Journal of Zoology-Revue Canadienne De Zoologie **77**:535-541.

Yeo, J. J. 2005. Effects of grazing exclusion on rangeland vegetation and soils, East Central Idaho. Western North American Naturalist **65**:91-102.

Appendices

Appendix 1: Point Count Data Visit 1

					0-3 minutes			3-5 minutes		
Date	Observers	Point #	Time	Species	≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
4/30/2012	CAE	101	6:21	WEME		4				
4/30/2012	CAE	101	6:21	HOLA		3				
4/30/2012	CAE	101	6:21	CORA			2			
4/30/2012	CAE	101	6:21	WCSP	3					
4/30/2012	CAE	101	6:21	AMRO					1	
4/30/2012	CAE	101	6:21	RWBL					1	
4/30/2012	CAE	102	6:41	WEME	1	5			2	
4/30/2012	CAE	102	6:41	MODO		2				
4/30/2012	CAE	102	6:41	LOSH		1				
4/30/2012	CAE	102	6:41	WCSP	3					
4/30/2012	CAE	102	6:41	GTTO		1				
4/30/2012	CAE	102	6:41	RNEP					1	
4/30/2012	CAE	103	6:59	WEME	1	8				
4/30/2012	CAE	103	6:59	GTTO	1					
4/30/2012	CAE	103	6:59	WCSP	1					
4/30/2012	CAE	103	6:59	RNEP		1				
4/30/2012	CAE	103	6:59	LASP	1				2	
4/30/2012	CAE	104	7:15	CORA			1			
4/30/2012	CAE	104	7:15	WEME		9				
4/30/2012	CAE	104	7:15	RNEP		1				
4/30/2012	CAE	104	7:15	LBCU		1				
4/30/2012	CAE	104	7:15	HOLA	2					
4/30/2012	CAE	104	7:15	WEME	2					
4/30/2012	CAE	105	7:33	WEME	1					
4/30/2012	CAE	105	7:33	WCSP	1					
4/30/2012	CAE	105	7:33	WEME	1	10				
4/30/2012	CAE	105	7:33	WCSP	3					
4/30/2012	CAE	105	7:33	SAVS	1					
4/30/2012	CAE	105	7:33	CORA			7			
4/30/2012	CAE	105	7:33	HOLA		1			1	
4/30/2012	CAE	105	7:33	GRSP	1					
4/30/2012	CAE	105	7:33	RNEP		1			1	
4/30/2012	CAE	106	7:48	WEME	1	9				
4/30/2012	CAE	106	7:48	GRSP	1					
4/30/2012	CAE	106	7:48	RNEP		2				
4/30/2012	CAE	106	7:48	AMCR			1			

Appendix 1: Point Count Data Visit 1

					0-3 minutes			3-5 minutes		
Date	Observers	Point #	Time	Species	≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
4/30/2012	CAE	106	7:48	CORA			3			1
4/30/2012	CAE	106	7:48	HOLA					1	
4/30/2012	CAE	107	8:02	WEME		12				
4/30/2012	CAE	107	8:02	GRSP	1					
4/30/2012	CAE	107	8:02	BBMA		1				
4/30/2012	CAE	107	8:02	CORA		2				
4/30/2012	CAE	107	8:02	HOLA		1			1	
4/30/2012	CAE	107	8:02	MODO		2				
4/30/2012	CAE	107	8:02	LBCU					1	
4/30/2012	CAE	108	8:20	WEME		11			1	
4/30/2012	CAE	108	8:20	GRSP		1				
4/30/2012	CAE	108	8:20	HOLA		1				
4/30/2012	CAE	108	8:20	WCSP					6	
4/30/2012	CAE	108	8:20	RCKI					1	
4/30/2012	CAE	108	8:20	CLSW						1
4/30/2012	CAE	108	8:20	WCSP	1					
4/30/2012	CAE	109	8:49	WEME		5				
4/30/2012	CAE	109	8:49	GRSP	1	1		1		
4/30/2012	CAE	109	8:49	HOLA		1				
4/30/2012	CAE	109	8:49	WCSP					1	
4/30/2012	CAE	110	9:08	WEME		8				
4/30/2012	CAE	110	9:08	GRSP		2				
4/30/2012	CAE	110	9:08	LBCU		1				
4/30/2012	CAE	110	9:08	HOLA		1		1		
4/30/2012	CAE	110	9:08	LASP		1				
4/30/2012	CAE	110	9:08	CORA						1
4/30/2012	CAE	110	9:08	AMCR						1
4/30/2012	CAE	111	9:24	CORA		2	2		1	
4/30/2012	CAE	111	9:24	WEME		7				
4/30/2012	CAE	111	9:24	HOLA		2				
4/30/2012	CAE	111	9:24	GRSP		1				
4/30/2012	CAE	112	9:41	LBCU		1			2	
4/30/2012	CAE	112	9:41	WEME		9				
4/30/2012	CAE	112	9:41	GRSP	1	1				
4/30/2012	CAE	112	9:41	HOLA		3				
4/30/2012	CAE	113	9:55	WEME		7			1	

Appendix 1: Point Count Data Visit 1

					0-3 minutes			3-5 minutes		
Date	Observers	Point #	Time	Species	≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
4/30/2012	CAE	113	9:55	CORA			1			
4/30/2012	CAE	113	9:55	CLSW			1			
4/30/2012	CAE	113	9:55	LBCU		1				
5/1/2012	CAE	114	5:55	WEME		8				
5/1/2012	CAE	114	5:55	HOLA		2				
5/1/2012	CAE	114	5:55	LBCU					2	
5/1/2012	CAE	115	6:21	WEME		10			1	
5/1/2012	CAE	115	6:21	LBCU		3				
5/1/2012	CAE	115	6:21	HOLA					1	
5/1/2012	CAE	116	6:34	WEME		5				
5/1/2012	CAE	116	6:34	GRSP	1	2				
5/1/2012	CAE	116	6:34	HOLA		3			1	
5/1/2012	CAE	117	6:52	WEME		5				
5/1/2012	CAE	117	6:52	LBCU		2			1	
5/1/2012	CAE	117	6:52	HOLA		1			1	
5/1/2012	CAE	117	6:52	GRSP	2					
5/1/2012	CAE	118	7:08	HOLA	3					
5/1/2012	CAE	118	7:08	LBCU		2				
5/1/2012	CAE	118	7:08	WEME		7				
5/1/2012	CAE	118	7:08	GRSP	1	1				
5/1/2012	CAE	118	7:08	HOLA		1				
5/1/2012	CAE	119	7:26	HOLA	2				1	
5/1/2012	CAE	119	7:26	WEME		7			1	
5/1/2012	CAE	119	7:26	GRSP	1	1				
5/1/2012	CAE	120	7:48	WEME		5				
5/1/2012	CAE	120	7:48	EUST			1			
5/1/2012	CAE	120	7:48	GRSP		1				
5/1/2012	CAE	121	8:08	WEME		5				
5/1/2012	CAE	121	8:08	CLSW			1			
5/1/2012	CAE	122	8:31	WEME		3			1	
5/1/2012	CAE	122	8:31	GRSP		1				
5/1/2012	CAE	122	8:31	HOLA		1				
5/1/2012	CAE	123	8:49	WEME		4				
5/1/2012	CAE	123	8:49	HOLA		2				
5/1/2012	CAE	123	8:49	LBCU		1			1	
5/1/2012	CAE	124	9:19	WEME		5			1	

Appendix 1: Point Count Data Visit 1

					0-3 minutes			3-5 minutes		
Date	Observers	Point #	Time	Species	≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
5/1/2012	CAE	124	9:19	GRSP					1	
5/1/2012	CAE	125	9:34	WEME		3			1	
5/1/2012	CAE	125	9:34	HOLA	3					
5/1/2012	CAE	125	9:34	GRSP		1				
5/1/2012	CAE	125	9:34	NOHA		1				
5/1/2012	CAE	125	9:34	CLSW			1			
5/1/2012	CAE	126	9:45	WEME	1					
5/1/2012	CAE	126	9:45	LASP	1					
5/1/2012	CAE	126	9:45	SAVS	1					
5/1/2012	CAE	126	9:45	HOLA		1				
5/1/2012	CAE	126	9:45	WEME		3				
5/1/2012	CAE	126	9:45	GRSP		1				
5/1/2012	CAE	126	9:45	WCSP	1					
5/1/2012	CAE	127	9:56	HOLA	1	2				
5/1/2012	CAE	127	9:56	WEME		3			1	
5/1/2012	CAE	127	9:56	WCSP	1					
5/1/2012	CAE	127	9:56	GRSP	1					
5/2/2012	CAE	128	6:04	WEME		6				
5/2/2012	CAE	128	6:04	WEKI		2				
5/2/2012	CAE	128	6:04	HOLA		3				
5/2/2012	CAE	128	6:04	RNEP		1				
5/2/2012	CAE	128	6:04	CLSW			2			
5/2/2012	CAE	128	6:04	GRSP		1				
5/2/2012	CAE	128	6:04	LBCU					1	
5/2/2012	CAE	129	6:17	WEME		6			2	
5/2/2012	CAE	129	6:17	HOLA		1			2	
5/2/2012	CAE	129	6:17	LBCU		1				
5/2/2012	CAE	129	6:17	RNEP		1				
5/2/2012	CAE	129	6:17	EUST			1			
5/2/2012	CAE	129	6:17	GRSP	1	1		1		
5/2/2012	CAE	130	6:31	WCSP	3					
5/2/2012	CAE	130	6:31	BRSP	1					
5/2/2012	CAE	130	6:31	WCSP	6					
5/2/2012	CAE	130	6:31	GRSP		2				
5/2/2012	CAE	130	6:31	WEME		11				
5/2/2012	CAE	130	6:31	HOLA		3				

Appendix 1: Point Count Data Visit 1

					0-3 minutes			3-5 minutes		
Date	Observers	Point #	Time	Species	≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
5/2/2012	CAE	130	6:31	LBCU		1				
5/2/2012	CAE	131	6:46	WEME		4				
5/2/2012	CAE	131	6:46	SAPH		1				
5/2/2012	CAE	131	6:46	GRSP		1				
5/2/2012	CAE	131	6:46	HOLA		2				
5/2/2012	CAE	131	6:46	KILL		1				1
5/2/2012	CAE	131	6:46	RNEP		1				
5/2/2012	CAE	131	6:46	CORA		1				
5/2/2012	CAE	131	6:46	WCSP		4				
5/2/2012	CAE	131	6:46	SAVS		1				
5/2/2012	CAE	131	6:46	EUCD					1	
5/2/2012	CAE	131	6:46	LBCU					1	
5/2/2012	CAE	132	7:03	HOLA	1	2			1	
5/2/2012	CAE	132	7:03	WEME		6				
5/2/2012	CAE	132	7:03	GRSP	1	2				
5/2/2012	CAE	132	7:03	RNEP		1				
5/2/2012	CAE	132	7:03	LBCU		1			2	
5/2/2012	CAE	133	7:22	HOLA	1	4		1	1	
5/2/2012	CAE	133	7:22	WEME		4				
5/2/2012	CAE	133	7:22	LBCU		1				
5/2/2012	CAE	133	7:22	RNEP		1				
5/2/2012	CAE	133	7:22	SAVS				1		
5/2/2012	CAE	134	7:37	WEME		6			1	
5/2/2012	CAE	134	7:37	HOLA	1	4				
5/2/2012	CAE	135	7:51	HOLA	1	3			2	
5/2/2012	CAE	135	7:51	WEME		4				
5/2/2012	CAE	135	7:51	GRSP		1				
5/2/2012	CAE	135	7:51	LBCU		1				
5/2/2012	CAE	136	8:06	LBCU	2					
5/2/2012	CAE	136	8:06	WEME		4				
5/2/2012	CAE	136	8:06	WCSP		2			1	
5/2/2012	CAE	136	8:06	HOLA		1				
5/2/2012	CAE	136	8:06	LBCU		1			2	
5/2/2012	CAE	137	8:22	WEME		6				
5/2/2012	CAE	137	8:22	WEKI					2	
5/2/2012	CAE	137	8:22	HOLA					1	

Appendix 1: Point Count Data Visit 1

					0-3 minutes			3-5 minutes		
Date	Observers	Point #	Time	Species	≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
5/2/2012	CAE	138	8:35	WEME		5				
5/2/2012	CAE	138	8:35	HOLA		1				
5/2/2012	CAE	138	8:35	GRSP	1					
5/2/2012	CAE	139	8:48	WEME	1	7				
5/2/2012	CAE	139	8:48	SWHA						1
5/2/2012	CAE	139	8:48	LOSH					1	
5/2/2012	CAE	140	9:04	WEME		5				
5/2/2012	CAE	140	9:04	SWHA						1
5/2/2012	CAE	140	9:04	WEKI					1	
5/2/2012	CAE	141	9:17	WEME		4				
5/2/2012	CAE	141	9:17	WCSP	1					
5/2/2012	CAE	142	9:33	WEME		4				
5/2/2012	CAE	142	9:33	RTHA			1			
5/2/2012	CAE	143	9:57	CLSW			2			4
5/2/2012	CAE	143	9:57	CORA			1			1
5/2/2012	CAE	143	9:57	WEME	1	4				
5/7/2012	CAE	144	6:41	WEME		10				
5/7/2012	CAE	144	6:41	GRSP	1					
5/7/2012	CAE	144	6:41	CORA			2			
5/7/2012	CAE	144	6:41	LBCU		2				
5/7/2012	CAE	144	6:41	EUST		1			4	
5/7/2012	CAE	144	6:41	RNEP		1			1	
5/7/2012	CAE	144	6:41	HOLA					3	
5/7/2012	CAE	144	6:41	BBMA					1	
5/7/2012	CAE	145	6:52	GRSP	1	1				
5/7/2012	CAE	145	6:52	HOLA	1	5				
5/7/2012	CAE	145	6:52	WEME		10				
5/7/2012	CAE	145	6:52	RNEP		1			1	
5/7/2012	CAE	145	6:52	CORA			3			
5/7/2012	CAE	145	6:52	UK..		13				
5/7/2012	CAE	145	6:52	AMCO		24				
5/7/2012	CAE	145	6:52	SAVS				1	1	
5/7/2012	CAE	146	7:07	CORA			15			
5/7/2012	CAE	146	7:07	LBCU	3	2				
5/7/2012	CAE	146	7:07	WEME		8				
5/7/2012	CAE	146	7:07	HOLA	2	1				

Appendix 1: Point Count Data Visit 1

					0-3 minutes			3-5 minutes		
Date	Observers	Point #	Time	Species	≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
5/7/2012	CAE	146	7:07	GRSP	1					
5/7/2012	CAE	146	7:07	RNEP					1	
5/7/2012	CAE	146	7:07	CAGU						6
5/7/2012	CAE	147	7:18	WEME		10				
5/7/2012	CAE	147	7:18	RNEP		3			1	
5/7/2012	CAE	147	7:18	HOLA		3			1	
5/7/2012	CAE	147	7:18	LBCU		3				
5/7/2012	CAE	147	7:18	GRSP	1	1				
5/7/2012	CAE	148	7:30	WEME		11				
5/7/2012	CAE	148	7:30	GRSP		1				
5/7/2012	CAE	148	7:30	LBCU		2				
5/7/2012	CAE	148	7:30	CORA			1			
5/7/2012	CAE	148	7:30	HOLA		3				
5/7/2012	CAE	148	7:30	RNEP		1				
5/7/2012	CAE	148	7:30	SAVS				1		
5/7/2012	CAE	149	7:41	GRSP	2					
5/7/2012	CAE	149	7:41	HOLA	2	1			1	
5/7/2012	CAE	149	7:41	WEME		7			1	
5/7/2012	CAE	149	7:41	LBCU					2	
5/7/2012	CAE	150	7:53	WEME		4				
5/7/2012	CAE	150	7:53	HOLA		5				
5/7/2012	CAE	150	7:53	GRSP		2				
5/7/2012	CAE	150	7:53	CORA						1
5/7/2012	CAE	151	8:04	LBCU		1				
5/7/2012	CAE	151	8:04	WEME	1	4				
5/7/2012	CAE	151	8:04	HOLA		3			2	
5/7/2012	CAE	151	8:04	CLSW			1			
5/7/2012	CAE	151	8:04	GRSP					1	
5/7/2012	CAE	152	8:15	WEME		4				
5/7/2012	CAE	152	8:15	GRSP		1				
5/7/2012	CAE	152	8:15	HOLA		5				
5/7/2012	CAE	152	8:15	SAVS		1				
5/7/2012	CAE	152	8:15	LBCU		2				
5/7/2012	CAE	152	8:15	WCSP				1		
5/7/2012	CAE	152	8:15	CORA						1
5/7/2012	CAE	153	8:30	LBCU	1			1		

Appendix 1: Point Count Data Visit 1

					0-3 minutes			3-5 minutes		
Date	Observers	Point #	Time	Species	≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
5/7/2012	CAE	153	8:30	WEME		4				
5/7/2012	CAE	153	8:30	HOLA		5				
5/7/2012	CAE	154	8:40	GRSP	1					
5/7/2012	CAE	154	8:40	WEME		5				
5/7/2012	CAE	154	8:40	HOLA		3			1	
5/7/2012	CAE	155	8:51	WEME		4			1	
5/7/2012	CAE	155	8:51	HOLA					3	
5/7/2012	CAE	155	8:51	GRSP					2	
5/7/2012	CAE	156	9:02	CORA			2			
5/7/2012	CAE	156	9:02	WEME		4			2	
5/7/2012	CAE	156	9:02	HOLA	2	2				
5/7/2012	CAE	157	9:15	WCSP		7				
5/7/2012	CAE	157	9:15	GRSP	1					
5/7/2012	CAE	157	9:15	LBCU		2				
5/7/2012	CAE	157	9:15	WEME		6				
5/7/2012	CAE	157	9:15	LBCU					1	
5/7/2012	CAE	157	9:15	NOHA						1
5/9/2012	CAE	158	7:34	WEME		4			1	
5/9/2012	CAE	158	7:34	HOLA		1				
5/9/2012	CAE	159	7:58	WEME		7				
5/9/2012	CAE	159	7:58	SAVS	2					
5/9/2012	CAE	159	7:58	HOLA		1				
5/9/2012	CAE	159	7:58	GRSP					1	
5/9/2012	CAE	159	7:58	LBCU					1	
5/9/2012	CAE	160	8:17	WEME		4			1	
5/9/2012	CAE	160	8:17	LBCU			1			
5/9/2012	CAE	160	8:17	CORA			1			
5/9/2012	CAE	160	8:17	UKHU			1			
5/9/2012	CAE	160	8:17	CAQU		1				
5/9/2012	CAE	160	8:17	HOLA					1	
5/9/2012	CAE	160	8:17	SAVS				1		
5/9/2012	CAE	160	8:17	GRSP				1		
5/9/2012	CAE	161	8:43	WEME		3			1	

Appendix 2: Point Count Data Visit 2

Date	Observers	Point #	Time	Species	0-3 minutes			3-5 minutes		
					≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
5/31/2012	CAE	155	9:55	WEME		8			1	
5/31/2012	CAE	155	9:55	GRSP		2				
5/31/2012	CAE	155	9:55	HOLA		4			1	
5/31/2012	CAE	155	9:55	CORA			4			
5/31/2012	CAE	155	9:55	RNEP		1				
5/31/2012	CAE	156	9:44	WEME		7				
5/31/2012	CAE	156	9:44	HOLA		3				
5/31/2012	CAE	156	9:44	GRSP		3				
5/31/2012	CAE	156	9:44	CORA			2			3
5/31/2012	CAE	157	9:29	WEME		6			1	
5/31/2012	CAE	157	9:29	HOLA		2				
5/31/2012	CAE	157	9:29	GRSP		1				
5/31/2012	CAE	157	9:29	GRSP	1					
5/31/2012	CAE	157	9:29	CORA			1			
5/31/2012	CAE	158	8:10	WEME		10			1	
5/31/2012	CAE	158	8:10	HOLA		2				
5/31/2012	CAE	158	8:10	LBCU		1				
5/31/2012	CAE	158	8:10	CAGU			11			
5/31/2012	CAE	158	8:10	GRSP		1			1	
5/31/2012	CAE	159	7:47	CAGU			4			
5/31/2012	CAE	159	7:47	WEME		10				
5/31/2012	CAE	159	7:47	LBCU		2				
5/31/2012	CAE	159	7:47	RWBL		1	1		2	
5/31/2012	CAE	159	7:47	RBGU			1			
5/31/2012	CAE	159	7:47	EUCD			1			
5/31/2012	CAE	160	7:26	GRSP					1	
5/31/2012	CAE	160	7:26	GRSP	3					
5/31/2012	CAE	160	7:26	LBCU		3				
5/31/2012	CAE	160	7:26	WEME		8			1	
5/31/2012	CAE	160	7:26	CAGU			1			
5/31/2012	CAE	160	7:26	RNEP		1				
5/31/2012	CAE	161	7:02	CAGU			5			
5/31/2012	CAE	161	7:02	WEME		13				
5/31/2012	CAE	161	7:02	LBCU		1				
5/31/2012	CAE	161	7:02	RNEP		1				
5/31/2012	CAE	161	7:02	GRSP		1				

Appendix 2: Point Count Data Visit 2

Date	Observers	Point #	Time	Species	0-3 minutes			3-5 minutes		
					≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
5/31/2012	CAE	161	7:02	CLSW						1
6/5/2012	CAE	151	7:22	WEME		5			2	
6/5/2012	CAE	151	7:22	GRSP	1					
6/5/2012	CAE	151	7:22	HOLA		1			1	
6/5/2012	CAE	151	7:22	CORA			2			
6/5/2012	CAE	152	6:28	HOLA	1	1				
6/5/2012	CAE	152	6:28	WEME		7				
6/5/2012	CAE	152	6:28	LBCU			1			
6/5/2012	CAE	153	6:15	WEME		5			1	
6/5/2012	CAE	153	6:15	LBCU		2			5	
6/5/2012	CAE	154	6:01	CORA		24				8
6/5/2012	CAE	154	6:01	LBCU		3				
6/5/2012	CAE	154	6:01	HOLA		1			1	
6/5/2012	CAE	154	6:01	WEME		3				
6/6/2012	CAE	130	10:00	WEME		4				
6/6/2012	CAE	130	10:00	HOLA	3	3	1			12
6/6/2012	CAE	131	9:51	WEME		5			1	
6/6/2012	CAE	131	9:51	HOLA		1				
6/6/2012	CAE	131	9:51	CLSW		2				
6/6/2012	CAE	131	9:51	EUCD			2			
6/6/2012	CAE	131	9:51	EUST		12				
6/6/2012	CAE	131	9:51	LOSH		1				
6/6/2012	CAE	131	9:51	WEKI					1	
6/6/2012	CAE	132	9:37	BARS			1			
6/6/2012	CAE	132	9:37	GRSP	1					
6/6/2012	CAE	132	9:37	WEME		1			1	
6/6/2012	CAE	132	9:37	HOLA					1	
6/6/2012	CAE	132	9:37	CORA						1
6/6/2012	CAE	133	9:24	WEME		5			1	
6/6/2012	CAE	133	9:24	LBCU	1					
6/6/2012	CAE	133	9:24	HOLA	1	1			1	
6/6/2012	CAE	133	9:24	EUST			1			1
6/6/2012	CAE	134	9:11	WEME		5			1	
6/6/2012	CAE	134	9:11	HOLA		4				
6/6/2012	CAE	134	9:11	CORA			1			
6/6/2012	CAE	134	9:11	GRSP		1				

Appendix 2: Point Count Data Visit 2

Date	Observers	Point #	Time	Species	0-3 minutes			3-5 minutes		
					≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
6/6/2012	CAE	135	8:57	WEME		3				
6/6/2012	CAE	135	8:57	HOLA		3				
6/6/2012	CAE	136	8:44	HOLA		2				
6/6/2012	CAE	137	8:31	HOLA	2					
6/6/2012	CAE	137	8:31	WEME		4				
6/6/2012	CAE	137	8:31	GRSP		2				
6/6/2012	CAE	137	8:31	RTHA			1			
6/6/2012	CAE	138	8:13	WEME		4			1	
6/6/2012	CAE	138	8:13	HOLA		2				
6/6/2012	CAE	138	8:13	CLSW						1
6/6/2012	CAE	139	8:02	WEME		4				
6/6/2012	CAE	139	8:02	HOLA		1				
6/6/2012	CAE	139	8:02	CLSW						4
6/6/2012	CAE	140	7:46	WEME		8				
6/6/2012	CAE	140	7:46	WEKI					1	
6/6/2012	CAE	141	7:34	LASP	1					
6/6/2012	CAE	141	7:34	WEME	1	3			2	
6/6/2012	CAE	141	7:34	RNEP					1	
6/6/2012	CAE	142	7:19	WEME		7				
6/6/2012	CAE	142	7:19	RNEP					1	
6/6/2012	CAE	143	7:00	CORA		9				
6/6/2012	CAE	143	7:00	WEME		4				
6/6/2012	CAE	143	7:00	CAGU			31			4
6/6/2012	CAE	143	7:00	HOLA		2				
6/6/2012	CAE	143	7:00	CLSW						2
6/6/2012	CAE	144	6:48	WEME		9			1	
6/6/2012	CAE	144	6:48	HOLA		2			1	
6/6/2012	CAE	144	6:48	CORA			8			
6/6/2012	CAE	144	6:48	LBCU		1				
6/6/2012	CAE	144	6:48	CAGU						2
6/6/2012	CAE	145	6:36	WEME		8			1	
6/6/2012	CAE	145	6:36	HOLA		2				
6/6/2012	CAE	145	6:36	CORA		2			2	
6/6/2012	CAE	145	6:36	GRSP		1				
6/6/2012	CAE	146	6:25	WEME		8				
6/6/2012	CAE	146	6:25	HOLA	1	1				

Appendix 2: Point Count Data Visit 2

					0-3 minutes			3-5 minutes		
Date	Observers	Point #	Time	Species	≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
6/6/2012	CAE	146	6:25	LBCU		1				
6/6/2012	CAE	146	6:25	GBHE						1
6/6/2012	CAE	146	6:25	CORA			1			
6/6/2012	CAE	146	6:25	GRSP				1		
6/6/2012	CAE	147	6:13	WEME		6			2	
6/6/2012	CAE	147	6:13	LBCU		3				
6/6/2012	CAE	147	6:13	HOLA		2				
6/6/2012	CAE	147	6:13	GRSP		1				
6/6/2012	CAE	147	6:13	RNEP		1				
6/6/2012	CAE	147	6:13	CAGU			1			3
6/6/2012	CAE	148	5:59	LBCU		3				
6/6/2012	CAE	148	5:59	CORA			3			
6/6/2012	CAE	148	5:59	WEME		8			2	
6/6/2012	CAE	148	5:59	HOLA		1				
6/6/2012	CAE	149	5:44	YHBL	6					
6/6/2012	CAE	149	5:44	WEME		4			2	
6/6/2012	CAE	149	5:44	HOLA		4		3		
6/6/2012	CAE	149	5:44	LBCU		2			1	
6/6/2012	CAE	149	5:44	CORA			9			
6/6/2012	CAE	149	5:44	YHBL		7				
6/6/2012	CAE	149	5:44	CAGU			2			
6/6/2012	CAE	149	5:44	GRSP					1	
6/6/2012	CAE	150	5:31	CORA			3			
6/6/2012	CAE	150	5:31	LBCU		2			2	
6/6/2012	CAE	150	5:31	GRSP		1				
6/6/2012	CAE	150	5:31	WEME		6				
6/6/2012	CAE	150	5:31	HOLA	2	2		1		
6/7/2012	CAE	106	9:50	WEME		7				
6/7/2012	CAE	106	9:50	CORA			9			
6/7/2012	CAE	106	9:50	BBMA		1				
6/7/2012	CAE	106	9:50	WEKI		1				
6/7/2012	CAE	107	9:43	WEME		10				
6/7/2012	CAE	107	9:43	CORA			1			1
6/7/2012	CAE	107	9:43	GBHE			1			
6/7/2012	CAE	107	9:43	LOSH					1	
6/7/2012	CAE	107	9:43	CLSW						2

Appendix 2: Point Count Data Visit 2

Date	Observers	Point #	Time	Species	0-3 minutes			3-5 minutes		
					≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
6/7/2012	CAE	108	9:31	WEME		9				
6/7/2012	CAE	108	9:31	HOLA		2				
6/7/2012	CAE	108	9:31	GRSP	1					
6/7/2012	CAE	108	9:31	CORA			2			
6/7/2012	CAE	108	9:31	CLSW			1			
6/7/2012	CAE	109	9:20	WEME	1	5			1	
6/7/2012	CAE	109	9:20	CORA			3			
6/7/2012	CAE	109	9:20	HOLA		1				
6/7/2012	CAE	109	9:20	WEKI		1				
6/7/2012	CAE	110	9:05	WEME	1					
6/7/2012	CAE	110	9:05	HOLA	4					
6/7/2012	CAE	110	9:05	LASP		2				
6/7/2012	CAE	110	9:05	CORA			3			
6/7/2012	CAE	110	9:05	WEME		7				
6/7/2012	CAE	110	9:05	HOLA		2				
6/7/2012	CAE	111	8:54	CLSW			3			
6/7/2012	CAE	111	8:54	WEME		9				
6/7/2012	CAE	111	8:54	CORA			4			
6/7/2012	CAE	111	8:54	HOLA		1				
6/7/2012	CAE	111	8:54	RNEP					1	
6/7/2012	CAE	111	8:54	AMGO						1
6/7/2012	CAE	112	8:42	WEME		9				
6/7/2012	CAE	112	8:42	HOLA		3				
6/7/2012	CAE	112	8:42	GRSP		2				
6/7/2012	CAE	112	8:42	BRSP		1				
6/7/2012	CAE	112	8:42	EUST			5			
6/7/2012	CAE	112	8:42	CORA			1			
6/7/2012	CAE	112	8:42	LBCU					2	
6/7/2012	CAE	113	8:32	WEME		7				
6/7/2012	CAE	113	8:32	HOLA	1				1	
6/7/2012	CAE	113	8:32	CORA			2			3
6/7/2012	CAE	113	8:32	GRSP		2				
6/7/2012	CAE	113	8:32	SATH		1				
6/7/2012	CAE	113	8:32	BRSP		1				
6/7/2012	CAE	113	8:32	LBCU					1	
6/7/2012	CAE	113	8:32	RNEP					1	

Appendix 2: Point Count Data Visit 2

					0-3 minutes			3-5 minutes		
Date	Observers	Point #	Time	Species	≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
6/7/2012	CAE	114	8:19	WEME		8			1	
6/7/2012	CAE	114	8:19	SATH		2				
6/7/2012	CAE	114	8:19	LASP		2				
6/7/2012	CAE	114	8:19	HOLA		2				
6/7/2012	CAE	114	8:19	LBCU		1				
6/7/2012	CAE	114	8:19	GRSP		1				
6/7/2012	CAE	115	8:02	WEME		9				
6/7/2012	CAE	115	8:02	LBCU		2				
6/7/2012	CAE	115	8:02	HOLA					1	
6/7/2012	CAE	115	8:02	CORA						1
6/7/2012	CAE	115	8:02	CLSW						1
6/7/2012	CAE	116	7:57	WEME		7				
6/7/2012	CAE	116	7:57	HOLA		6	1			
6/7/2012	CAE	116	7:57	GRSP	1	1				
6/7/2012	CAE	116	7:57	RNEP		1				
6/7/2012	CAE	116	7:57	CORA			2			
6/7/2012	CAE	117	7:39	WEME		5			1	
6/7/2012	CAE	117	7:39	HOLA		2				
6/7/2012	CAE	117	7:39	GRSP	1	1		1		
6/7/2012	CAE	117	7:39	LBCU		2				
6/7/2012	CAE	117	7:39	CORA						1
6/7/2012	CAE	118	7:28	WEME		7				
6/7/2012	CAE	118	7:28	LBCU		2	1			
6/7/2012	CAE	118	7:28	HOLA		4				
6/7/2012	CAE	118	7:28	LASP		1				
6/7/2012	CAE	118	7:28	GRSP		1		2		
6/7/2012	CAE	118	7:28	RNEP					1	
6/7/2012	CAE	118	7:28	CORA						1
6/7/2012	CAE	119	7:16	WEME		10				
6/7/2012	CAE	119	7:16	GRSP	2	1				
6/7/2012	CAE	119	7:16	HOLA		4				
6/7/2012	CAE	119	7:16	LBCU		1				
6/7/2012	CAE	119	7:16	CANG		10				
6/7/2012	CAE	119	7:16	RWBL						1
6/7/2012	CAE	120	7:02	WEME		8		1		
6/7/2012	CAE	120	7:02	LASP	1	2				

Appendix 2: Point Count Data Visit 2

Date	Observers	Point #	Time	Species	0-3 minutes			3-5 minutes		
					≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
6/7/2012	CAE	120	7:02	SATH		1				
6/7/2012	CAE	120	7:02	SWHA			1			
6/7/2012	CAE	120	7:02	HOLA		1				
6/7/2012	CAE	121	6:51	WEME		8				
6/7/2012	CAE	121	6:51	HOLA		2			1	
6/7/2012	CAE	121	6:51	LASP		2			1	
6/7/2012	CAE	121	6:51	LBCU		1				
6/7/2012	CAE	121	6:51	CORA			1			
6/7/2012	CAE	121	6:51	RNEP		1				
6/7/2012	CAE	121	6:51	SATH		1				
6/7/2012	CAE	122	6:38	LBCU	1	1				
6/7/2012	CAE	122	6:38	GRSP	1	2				
6/7/2012	CAE	122	6:38	WEME		3			1	
6/7/2012	CAE	122	6:38	CORA			1			
6/7/2012	CAE	122	6:38	CANG		10				
6/7/2012	CAE	122	6:38	HOLA	1	2				
6/7/2012	CAE	122	6:38	RNEP					1	
6/7/2012	CAE	123	6:27	WEME		9			1	
6/7/2012	CAE	123	6:27	LBCU		2				
6/7/2012	CAE	123	6:27	GRSP		1			1	
6/7/2012	CAE	123	6:27	GRSP				1		
6/7/2012	CAE	123	6:27	RNEP		1				
6/7/2012	CAE	123	6:27	CORA			9			
6/7/2012	CAE	123	6:27	CANG		10				
6/7/2012	CAE	123	6:27	HOLA		2				
6/7/2012	CAE	124	6:15	WEME		9				
6/7/2012	CAE	124	6:15	LBCU		2				
6/7/2012	CAE	124	6:15	CORA			4			
6/7/2012	CAE	124	6:15	HOLA		5				
6/7/2012	CAE	124	6:15	CANG		20				
6/7/2012	CAE	124	6:15	CONI			2			
6/7/2012	CAE	125	6:00	WEME		10				
6/7/2012	CAE	125	6:00	HOLA		1			1	
6/7/2012	CAE	125	6:00	GRSP		1			1	
6/7/2012	CAE	125	6:00	GRSP	1					
6/7/2012	CAE	125	6:00	RWBL			2			

Appendix 2: Point Count Data Visit 2

Date	Observers	Point #	Time	Species	0-3 minutes			3-5 minutes		
					≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
6/7/2012	CAE	125	6:00	CANG		20				
6/7/2012	CAE	125	6:00	RNEP		1				
6/7/2012	CAE	125	6:00	LBCU		1				
6/7/2012	CAE	125	6:00	CORA			2			4
6/7/2012	CAE	125	6:00	BUOR		1				
6/7/2012	CAE	126	5:49	WEME		10			1	
6/7/2012	CAE	126	5:49	LBCU	2					
6/7/2012	CAE	126	5:49	HOLA		5			1	
6/7/2012	CAE	126	5:49	GRSP	1	1				
6/7/2012	CAE	126	5:49	GRSP	1					
6/7/2012	CAE	126	5:49	CANG		20				
6/7/2012	CAE	126	5:49	CORA						2
6/7/2012	CAE	126	5:49	LASP					1	
6/7/2012	CAE	127	5:37	WEME		7				
6/7/2012	CAE	127	5:37	HOLA	1	4	3			
6/7/2012	CAE	127	5:37	GRSP	1	1				
6/7/2012	CAE	127	5:37	GRSP	1			1		
6/7/2012	CAE	127	5:37	BUOR					1	
6/7/2012	CAE	127	5:37	MODO						1
6/7/2012	CAE	127	5:37	FEHA		2				
6/7/2012	CAE	128	5:24	WEME		12				
6/7/2012	CAE	128	5:24	WEKI		2				
6/7/2012	CAE	128	5:24	HOLA		1				
6/7/2012	CAE	128	5:24	MODO		1				
6/7/2012	CAE	128	5:24	LASP	2					
6/7/2012	CAE	128	5:24	AMCR		1				
6/7/2012	CAE	128	5:24	GRSP					1	
6/7/2012	CAE	128	5:24	CORA						2
6/7/2012	CAE	128	5:24	BBMA					2	
6/7/2012	CAE	129	5:11	WEME		8				
6/7/2012	CAE	129	5:11	HOLA		7				
6/7/2012	CAE	129	5:11	GRSP	1	3				
6/7/2012	CAE	129	5:11	GRSP	1					
6/7/2012	CAE	129	5:11	MODO		1				
6/7/2012	CAE	129	5:11	CANG		10				
6/7/2012	CAE	129	5:11	LBCU					1	

Appendix 2: Point Count Data Visit 2

Date	Observers	Point #	Time	Species	0-3 minutes			3-5 minutes		
					≤ 50m	> 50m	Fly-Overs	≤ 50m	> 50m	Fly-Overs
6/7/2012	CAE	129	5:11	RNEP					1	
6/8/2012	CAE	101	7:21	SWHA	1					
6/8/2012	CAE	101	7:21	SWHA			1			1
6/8/2012	CAE	101	7:21	RTHA		1				
6/8/2012	CAE	101	7:21	WEME		6				
6/8/2012	CAE	101	7:21	HOLA		2				
6/8/2012	CAE	101	7:21	WEKI		2				
6/8/2012	CAE	101	7:21	CORA			1			
6/8/2012	CAE	101	7:21	LASP		2				
6/8/2012	CAE	101	7:21	RNEP					1	
6/8/2012	CAE	102	6:37	WEME		10				
6/8/2012	CAE	102	6:37	CORA			2			
6/8/2012	CAE	102	6:37	HOLA		2				
6/8/2012	CAE	102	6:37	LASP		1				
6/8/2012	CAE	102	6:37	GRSP		2				
6/8/2012	CAE	102	6:37	LBCU					1	
6/8/2012	CAE	103	7:02	WEME		10			2	
6/8/2012	CAE	103	7:02	HOLA		2				
6/8/2012	CAE	103	7:02	CORA						1
6/8/2012	CAE	104	6:18	WEME		10				
6/8/2012	CAE	104	6:18	RNEP		1				
6/8/2012	CAE	104	6:18	NOHA			1			
6/8/2012	CAE	104	6:18	CORA			2			1
6/8/2012	CAE	104	6:18	CAGU			3			1
6/8/2012	CAE	104	6:18	HOLA	1	1				
6/8/2012	CAE	105	6:03	CORA			20			9
6/8/2012	CAE	105	6:03	GRSP	3					
6/8/2012	CAE	105	6:03	WEME		11				
6/8/2012	CAE	105	6:03	CONI			1			
6/8/2012	CAE	105	6:03	RNEP		1			1	
6/8/2012	CAE	105	6:03	LBCU					1	