Wildlife on Conservation Reserve Program lands and native shrubsteppe in Washington

Progress Report: 2003

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Cover Photo: Conservation Reserve Program field planted to big sagebrush and a mix of native and non-native grasses and forbs, Douglas County, Washington. Native shrubsteppe can be seen in the background.

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Abstract

The Conservation Reserve Program (CRP) is currently the only large-scale effort to restore habitat that may be used by grassland and shrubsteppe wildlife in the Columbia River Basin. Administered by the US Department of Agriculture, this voluntary program pays farmers to take agricultural lands out of production to achieve conservation objectives including reducing soil erosion and providing wildlife habitat. In Washington, over 1 million acres (405,000 ha) of converted farmland has been planted to non-native grasses and to native grasses, forbs and shrubs under the CRP. In 2003 we began a study to evaluate the potential role of CRP in the long-term conservation of obligate grassland and shrubsteppe wildlife in the Columbia River Basin. We established 48 study sites in CRP fields of varying age and landscape contexts and in extant shrubsteppe communities. From April-October 2003 we surveyed for birds, herptiles, and small mammals and we examined reproductive parameters of selected bird species. Preliminary data from the first year of study show a bird community dominated by grassland species in CRP sites. This pattern was not unexpected and reflects the structure of the vegetation and its similarity to native steppe communities. Three shrubsteppe-obligate passerines (Sage Sparrow, Sage Thrasher, and Brewer's Sparrow) also occurred in CRP stands, with Brewer's Sparrows occurring in considerable numbers. Highest numbers of all 3 species were recorded in old CRP sites in shrubsteppe-dominated landscapes, likely reflecting the increased occurrence and height of big sagebrush in these old CRP stands. Nesting data confirmed that these shrubsteppe-obligate birds were breeding successfully on some CRP sites, with numbers of Brewer's Sparrow nests found in some CRP sites approaching that found in extant shrubsteppe. Most color-banded males successfully paired, and a preliminary look at the nesting success data suggests that nests in CRP fields were at least as successful as those in shrubsteppe sites. Surveys for herptiles in 2003 revealed a greater number and diversity in extant shrubsteppe embedded within shrubsteppe landscapes than in other site types. Shrubsteppe sites in agricultural landscapes and old CRP plots embedded in shrubsteppe landscapes supported some, but not all of the species locally present. New CRP plots within either landscape and old CRP plots in agricultural landscapes were depauperate of herptiles. We captured $\geq$ 10 species of small mammals during approx. 23,000 trap nights in September and October. Three species, the deer mouse, Great Basin pocket mouse, and western harvest mouse made up 90% of captures. Other species captured included the least chipmunk, sagebrush vole, montane vole, long-tailed vole, northern pocket gopher, Merriam's shrew, and vagrant shrew. Three rodents (deer mouse, western harvest mouse, and sagebrush vole) showed trends toward higher average relative abundance in CRP fields than on shrubsteppe sites. The Great Basin pocket mouse had similar captures across all site types whereas least chipmunks were captured mainly in shrubsteppe habitats. Field data collection for all 3 species groups will be repeated in 2004. In addition, the vegetation at all 48 study sites will be characterized so that we may further define the habitat relationships of wildlife in CRP and shrubsteppe communities. A third year of data collection in 2005 would be desirable but is contingent on additional funding.

Results presented above are preliminary: more detailed analysis and inclusion of additional data in 2004 may reveal different trends

Introduction

Shrubsteppe historically was the dominant habitat in eastern Washington (Daubenmire 1970). Daubenmire described shrubsteppe as vegetative communities consisting of one or more layers of perennial grass with a conspicuous but discontinuous overstory layer of shrubs. Although the dominant shrub is usually big sagebrush (*Artemisia tridentata*), other shrubs may also be common including threetip sagebrush (*A. tripartita*), rabbitbrush (*Chrysothamnus nauseosus*), bitterbrush (*Purshia tridentata*), greasewood (*Sarcobatus vermiculatus*), and spiny hopsage (*Grayia spinosa*). Shrubsteppe is considered a 'priority habitat' within the state of Washington (WDFW 2001) that warrants special management considerations due to threats from human-associated causes.

Today, less than 40% of Washington's historic shrubsteppe remains, and much of it is degraded, fragmented, and/or isolated from other similar habitats (Jacobson and Snyder 2000, Vander Haegen et al. 2000). The distribution, density, and diversity of shrubsteppe wildlife has been adversely affected by habitat conversion for crop production (Buss and Dziedzic 1955, Swenson *et al*. 1987, Vander Haegen *et al*. 2000) and hydropower (Howerton 1986), a differentially high loss of deep-soil communities (Dobler *et al*. 1996), fragmentation through habitat conversion, roads, power lines, and fences (Vander Haegen *et al*. 2001), and alteration of the vegetation through over-grazing, invasion by exotic plants, and changes in fire frequency (Yensen *et al*. 1992, Pashley *et al*. 2000, Vander Haegen *et al*. 2001). Various mapping efforts have provided information on the extent of remaining shrubsteppe in eastern Washington (Dobler et al. 1996, Jacobson and Snyder 2000), but detailed data exist only for a few tracts of mostly public lands.

Loss and degradation of once extensive shrubsteppe communities has greatly reduced the habitat available to a wide range of shrubsteppe-associated wildlife including several birds restricted to this community type (Quigley and Arbelbide 1997, Saab and Rich 1997, Vander Haegen et al. 2000). Sage sparrows, Brewer's sparrows, sage thrashers, and sage grouse are considered shrubsteppe obligates and numerous other species are associated primarily with shrubsteppe at a regional scale. In a recent analysis of birds at risk within the interior Columbia River Basin, most species identified having a high management concern were shrubsteppe species. Moreover, according to the Breeding Bird Survey, half these species have experienced long-term declines in their populations (Saab and Rich 1997). In Washington, greater sage-grouse, sharp-tailed grouse, and ferruginous hawk are listed as state threatened, and sage sparrow, sage thrasher, loggerhead shrike, and golden eagle are listed as state candidates (scientific names for wildlife species mentioned in the text are listed in the Appendix).

Previous work on shrubsteppe passerines in Washington has examined the relationship between various site-specific parameters and species occurrence and abundance (Rotenberry and Wiens 1980, Dobler et al. 1996, Vander Haegen et al. 2000). Sage sparrows are associated with less annual grass in the herbaceous layer, and grasshopper sparrows with more perennial grass. Brewer's sparrows and sage thrashers are less abundant in shrubsteppe habitats of relatively poor quality (Vander Haegen et al. 2000). Habitat-specific population parameters, including productivity, dispersal, and adult and juvenile survival are unknown for most of these species. Fragmentation and degradation of shrubsteppe adversely affect some species, although relatively few have been studied. Sage sparrows are less abundant (Vander Haegen et al. 2000) and Brewer's sparrows and sage thrashers are less productive (Vander Haegen et al. 2002, WDFW, unpubl. data) in fragmented landscapes. Rates of parasitism by brown-headed cowbirds (*Molothrus ater*) were found to be low for several shrubsteppe obligate passerines in Washington and were greater in fragmented than in continuous sites for Brewer's Sparrows (Vander Haegen and Walker 1999; WDFW unpubl. data).

Few studies of small mammals (shrews and rodents) have been conducted in the shrubsteppe habitats of eastern Washington except for studies at the Hanford Reservation, the Arid Lands Ecology Reserve, and the Yakima Training Center (West *et al*. 1999). Gitzen *et al*. (2001) recently completed one of the larger investigations of small mammals in the shrubsteppe at the Hanford Reservation; Great Basin pocket mice, deer mice, western harvest mice, grasshopper mice, and sagebrush voles were the primary species captured. Given that conditions at previously studied sites do not represent ecological conditions present in much of the remainder of eastern Washington, extrapolation of species habitat occurrence and abundance patterns from these areas may be unwarranted. For some shrubsteppe mammals in Washington, almost no data on current population status and trends and habitat requirements are available, and for some species, even the statewide distribution is poorly known (Johnson and Cassidy 1997). This basic information is needed to prioritize management actions.

No studies have specifically addressed the habitat associations of reptiles and amphibians in Washington's shrubsteppe. Even the distribution of most species is poorly known. At a coarse scale, many species are associated with shrubsteppe (Vander Haegen et al. 2001). Of these, the sharptail snake and striped whipsnake are state candidates for threatened status, the night snake is a state monitor species in Washington, the sagebrush lizard is a federal species of concern, and the northern leopard frog is endangered in Washington State. Declines associated with habitat loss are suspected, but the status of most amphibians and reptiles is unknown.

The Conservation Reserve Program (CRP) is currently the only large-scale effort to restore habitat that may be used by grassland and shrubsteppe wildlife in the Columbia River Basin. Administered by the US Department of Agriculture (USDA), this voluntary program pays farmers to take agricultural lands out of production to achieve conservation objectives including reducing soil erosion and providing wildlife habitat. In Washington, over 1 million acres (405,000 ha) of converted farmland has been planted to non-native grasses and to native grasses, forbs and shrubs under the CRP (Fig. 1). The program allows farmers to enroll lands for periods of 10-15 years, with periodic opportunities for entering land into the program. While not an ideal solution to the problem of declining native habitat, CRP has enormous potential to provide habitat for many grassland and shrubsteppe species. The current acreage of CRP land in eastern Washington is equal to almost 15% of the state's total agricultural lands. Despite the potential of CRP land as wildlife habitat, no studies have examined use of these lands by grassland and shrubsteppe obligate wildlife in the Columbia River Basin.

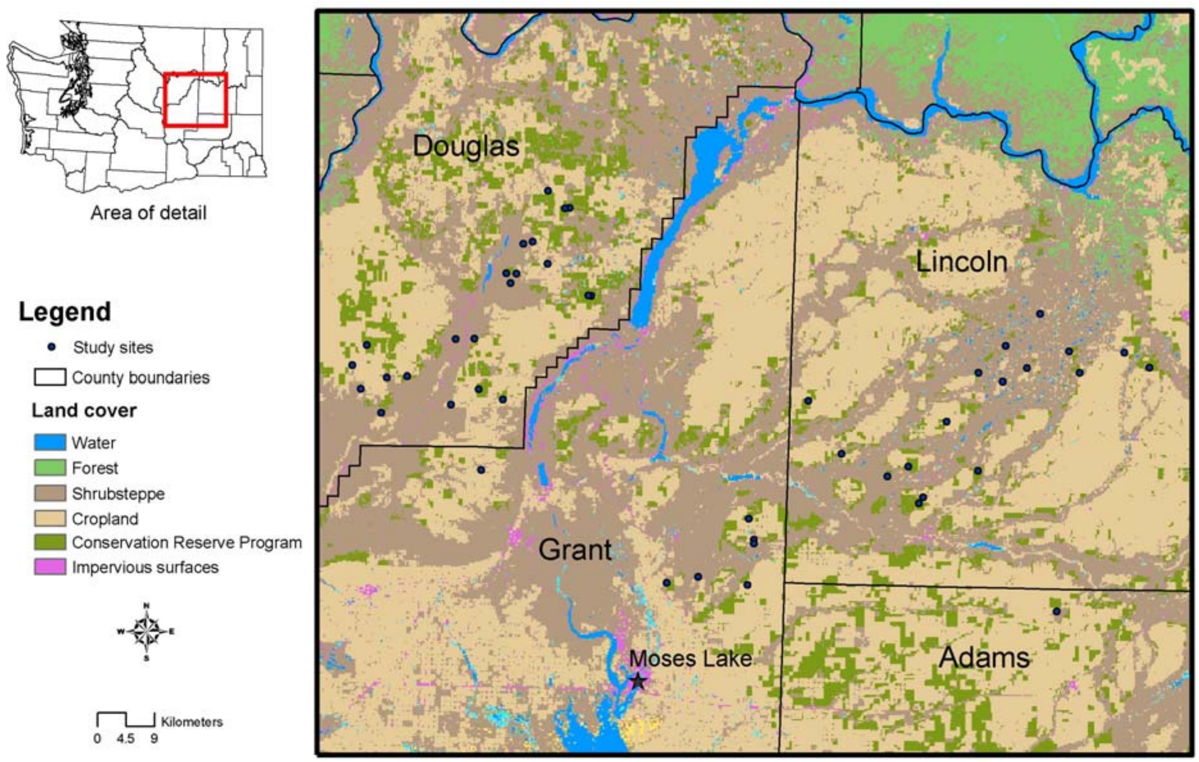

Figure 1. Location of study sites in eastern Washington. Land cover derived from Landsat imagery and aerial photographs in 1996.

Studies in the mid-west have documented a variety of grassland birds using CRP fields (Patterson and Best 1996, Eggebo 2001). In Washington, Grasshopper sparrows, Columbian sharp-tailed grouse, and the greater sage-grouse are known to use CRP fields (WDFW unpublished data) and there is the potential for use by other grassland birds such as short-eared owls, burrowing owls, horned larks, and western meadowlarks. Although CRP fields have historically been planted to a variety of non-native grasses, more recently an increasing number of fields have been planted to native grasses, forbs, and native arid-land shrubs. Moreover, native shrubs (particularly big sage) frequently seed-in from adjacent shrubsteppe, making some fields of potential use to shrub-nesting species such as sage sparrows, Brewer's sparrows, and loggerhead shrikes.

The general goal of this research is to evaluate the potential role of CRP in the long-term conservation of obligate grassland and shrubsteppe wildlife in the Columbia River Basin. The specific objectives are to 1) compare wildlife populations in CRP lands with those in nearby native shrubsteppe, 2) compare wildlife populations in CRP lands of different ages and in different landscape contexts, 3) derive species-habitat relationships for poorly understood bird, mammal, and reptile species that depend on shrubsteppe, and 4) provide information that will support management of CRP in Washington to benefit shrubsteppe associated wildlife.

Study design

We will compare wildlife communities in CRP fields and those in native shrubsteppe. There are 6 "treatments": 3 vegetation communities, each represented in landscapes dominated by agriculture and in landscapes dominated by shrubsteppe (Table 1). Study sites are clustered into 8 study areas or "clusters". Each cluster has six study sites; one of each "treatment" type. Shrubsteppe communities are dominated by native vegetation, with an overstory of big sagebrush and an understory of bunchgrasses and forbs. "New" CRP communities are former agricultural lands planted in the last sign-up (1998-2000) to a mix of non-native and native species including big sagebrush. Old CRP communities are former agricultural fields planted to non-native bunchgrasses in previous sign-ups (1986-1988). Each study site has a single survey plot of 25ha. Each plot contains 4 100-m fixed-radius point counts (Ralph et al. 1993) spaced 300m apart (100m buffer between each circle perimeter) (Fig 2). This 25ha study plot is the focus of all survey work.

Table 1. Study site configurations used in shrubsteppe restoration study.

Vegetation community	Landscape
Shrubsteppe	Shrubsteppe dominated
Shrubsteppe	Agricultural dominated
New CRP (planted 1998-2000)	Shrubsteppe dominated
New CRP (planted 1998-2000)	Agricultural dominated
Old CRP (planted 1986-1988)	Shrubsteppe dominated
Old CRP (planted 1986-1988)	Agricultural dominated

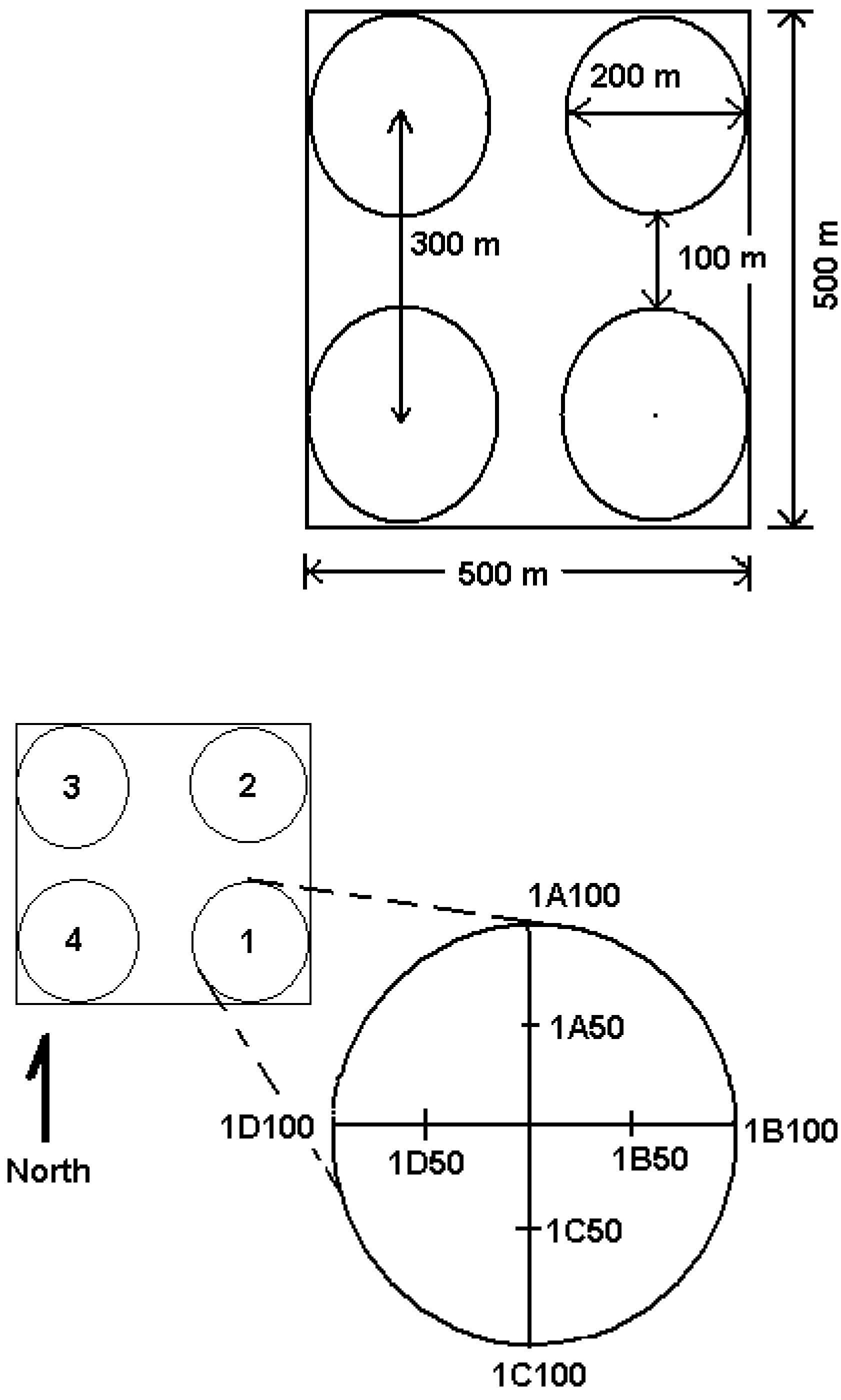

Fig. 2. *Top*. Sample design for study sites illustrating the configuration of the four 100-m fixed-radius point counts within the 25 ha square plot. Each of 4 center points were marked with a permanent fiberglass stake (1m electric fence post). A metal washer at the base of each stake is stamped with the point number. *Bottom.* Colored flagging was placed on shrubs (or bamboo stakes) at 50m and at 100m from the point in each of the 4 cardinal directions to aid in determining distance during point counts. Points on each "arm" are labeled as shown with the number of the point, followed by the letter of the "arm", and the distance from the center point.

Each of the 48 study sites is identified by a four-letter code (Table 2). The first two letters are the first letters of each word of the study area name. The third letter can be "N" for new CRP, "O" for old CRP, or "S" for shrubsteppe. The fourth letter describes the landscape surrounding each plot and can be "C" for cropland or "S" for shrubsteppe (e.g., "SFSS" is Sagebrush Flats study area, Shrubsteppe site in a Shrubsteppe landscape).

Table 2. Four-letter codes for each of 48 study sites. Shrubsteppe (SS) and Conservation Reserve Program (CRP) "vegetation types" in each of 2 landscapes (Shrubsteppe dominated and cropland dominated).

Study Area (cluster)	SS in shrubsteppe	SS in cropland	New CRP in shrubsteppe	New CRP in cropland	Old CRP in shrubsteppe	Old CRP in cropland
Chester Butte	CBSS	CBSC	CBNS	CBNC	CBOS	CBOC
Black Rock	BRSS	BRSC	BRNS	BRNC	BROS	BROC
Jameson Lake	JLSS	JLSC	JLNS	JLNC	JLOS	JLOC
Pine Canyon	PCSS	PCSC	PCNS	PCNC	PCOS	PCOC
Pacific Lake	PLSS	PLSC	PLNS	PLNC	PLOS	PLOC
Coyote Canyon	CCSS	CCSC	CCNS	CCNC	CCOS	CCOC
Swanson Lake	SLSS	SLSC	SLNS	SLNC	SLOS	SLOC
Tracy Rock	TRSS	TRSC	TRNS	TRNC	TROS	TROC

PASSERINE BIRDS

Introduction

Our objectives were to measure the occurrence and abundance of avian species using each of the 6 treatments and to document reproductive success at 2 levels: success rates of individual nests, and seasonal fecundity of individual focal birds.

Methods

Abundance— We surveyed birds on all study plots using fixed-radius point-counts (Ralph et al. 1993). Counts at each point were 5 minutes in duration during which all birds seen or heard were noted, along with their sex (if known), distance from the point (within 50m, >50 but <100m, or beyond 100m), and behavior (singing, calling, silent, or flying over the site). Surveys were conducted once each in May and June and within prescribed weather parameters (i. e., no rain and low wind). Layout of point-count plots is illustrated in figure 2.

Productivity—We measured reproductive parameters on all study sites in shrubsteppe landscapes (OS, NS, SS). We located nests by following behavioral cues (e.g., adults carrying nest material or food) and by searching likely areas of the 25-ha study plots. Once found, nests were marked with a single piece of colored flagging placed ≥8m distant and status (number of eggs/young) was noted. We visited nests every 3-4 days until fledging or failure.

We used a modification of the Vickery technique (Vickery et al. 1992) to assess the seasonal productivity of selected species (Brewer's Sparrow, Savannah Sparrow, and Vesper Sparrow). We used mist nets and song play-back to capture and color-band the male of each focal species that was singing nearest to each point-count center. If a point had no male singing nearby, we attempted to capture and mark a second male at another point. Focal (color-banded) males were visited twice each week in order to obtain clues to their reproductive status. We attempted to follow each male for a minimum of 30 min during each visit, looking for evidence of pairing, nesting, and successful fledging of one or more nests. On visits where the male could not be relocated we spent 30 min searching his activity area for nests or for signs of a female feeding young. Focal male studies were restricted to sites in shrubsteppe landscapes due to logistical constraints.

Results

Abundance—We counted 4625 individual birds on 384 point-counts in 2003. Of those, 2394 were counted within the 100m-radius circle (Table 3). Savannah Sparrows were the most abundant species occurring in new CRP fields, whereas Horned Larks were the most abundant in old CRP. Brewer's Sparrows and Western Meadowlarks were the most abundant species in shrubsteppe sites, with meadowlarks attaining greater numbers in shrubsteppe landscapes and Brewer's Sparrows attaining greater numbers in agricultural landscapes.

All site types had a high number of individual birds counted, ranging from 344 in OC sites to 449 in SS sites. Shrubsteppe sites had a more diverse bird community, including several shrubsteppe-associated species that were not recorded in CRP sites (Lark Sparrow, Loggerhead Shrike, Black-billed Magpie, Say's Phoebe). Sixteen species were counted >1 time on surveys in SS sites (14 were counted in SC sites); 12 species were counted in OS sites; and 7 or fewer were counted in the other CRP site types (Table 3).

Productivity—We located and tracked the fates of 341 nests on the study sites (Table 4). Nests of the 3 focal species (Brewer's Sparrow, Savannah Sparrow, and Vesper Sparrow) made up 69% of the total sample of nests found. The most common nests found in SS and OS plots were those of Brewer's Sparrows; Savannah Sparrow nests were found most often in NS plots. Of interest, nests of the 3 shrubsteppe obligates (Sage Sparrow, Brewer's Sparrows, and Sage Thrashers) were found in some CRP fields when shrubs were present. Apparent nest success (number fledged/number tracked) for all species combined was 0.56 in SS (n = 128), 0.64 in NS (n = 52) and 0.73 in OS (n = 113) sites. The same trend towards greater apparent nest success in CRP fields compared to shrubsteppe sites followed for Brewer's Sparrows, Savannah Sparrows, and Vesper Sparrows. Caution must be exercised when considering these trends: planned analyses using the more rigorous Mayfield method may reveal different results.

Table 3. Birds counted on point-count surveys (within 100m) in 2003, summed across plots by site class.

Species code	NC	NS	OC	OS	SC	SS	Total
Horned Lark	93	110	102	123	60	35	523
Savannah Sparrow	142	118	100	56	26	26	468
Grasshopper Sparrow	102	98	87	70	17	9	383
Brewer's Sparrow	5	7	11	55	110	103	291
Western Meadowlark	13	37	14	29	58	117	268
Vesper Sparrow	18	27	30	46	66	65	252
Brown-headed Cowbird		1		2	28	16	47
Sage Thrasher	1			3	21	14	39
Brewer's Blackbird	1	4		3	18	9	35
Sage Sparrow				2	2	29	33
Lark Sparrow						12	12
Cliff Swallow				8	3		11
Mourning Dove	1			2	2	4	9
Red-winged Blackbird					5		5
Loggerhead Shrike					1	3	4
Black-billed Magpie						3	3
House Finch					3		3
Ring-necked Pheasant				1	1		2
Rock Wren						2	2
Say's Phoebe						2	2
Common Nighthawk					1		1
Long-billed Curlew	1						1
Total	377	402	344	400	422	449	2394

We banded a total of 259 birds across 24 sites in shrubsteppe landscapes (Table 5). Twenty-nine Grasshopper Sparrows also were banded but were not included in focal male studies. Many males banded early in the year never were resighted and likely had not yet established territories or perhaps had not completed migration when captured. Brewer's Sparrows and Savannah Sparrows proved to be the most suitable for focal studies, occurring in good numbers in SS sites and in at least one of the 2 CRP classes. Vesper Sparrows occurred in all 3 site classes but proved difficult to follow in CRP fields, apparently establishing large territories that frequently included adjacent habitats. Sage Sparrows occurred only rarely in CRP sites. Focal male studies began later than planned, reducing the number of visits possible and therefore the number of males with 10 or more visits.

Table 4. Nests found and tracked in 2003, summed across plots by site class. Nest-searching and related demographic work was focused on study sites in shrubsteppe landscapes (site types SS, OS, and NS), resulting in a greater number of nests found in these site types.

Species	NC	NS	OC	OS	SC	SS	Total
Brewer's Sparrow		9		41	12	54	116
Savannah Sparrow	9	18	2	18		14	61
Vesper Sparrow	2	8		19	7	22	58
Horned Lark	8	10	3	14	3	3	41
Western Meadowlark		3		4	1	8	16
Sage Thrasher				6	2	5	13
Mourning Dove				2	3	7	12
Grasshopper Sparrow	1			5		1	7
Sage Sparrow				2		5	7
Common Nighthawk						4	4
Burrowing Owl		1					1
Eastern Kingbird						1	1
Killdeer						1	1
Lark Sparrow						1	1
Northern Harrier				1			1
Say's Phoebe						1	1
Total	20	49	5	112	28	127	341

Table 5. Count of birds color-banded and tracked ≥10 times during focal male studies on sites in shrubsteppe landscapes, summed across plots within site class.

		Number tracked			
Species	Number banded	NS	OS	SS	Total
Brewer's Sparrow	84	1	9	19	29
Sage Sparrow	14	0	0	4	4
Savanna Sparrow	98	17	12	7	36
Vesper Sparrow	63	4	4	8	16
Total	259	22	25	38	85

Discussion

Preliminary data from the first year of study show a bird community dominated by grassland species in CRP sites. This pattern was not unexpected and reflects the structure of the vegetation and its similarity to native steppe communities. Three shrubsteppe-obligate passerines (Sage Sparrow, Sage Thrasher, and Brewer's Sparrow) also occurred in CRP stands, with Brewer's Sparrows occurring in considerable numbers. Highest numbers of all 3 species were recorded in OS sites, likely reflecting the increased occurrence and height of big sagebrush in these old CRP stands. All 3 of these species typically nest on or beneath sagebrush shrubs. Nesting data confirmed that these shrubsteppe-obligates were breeding successfully on these CRP sites, with numbers of

Brewer's Sparrow nests found in OS sites approaching that found in shrubsteppe controls (SS). Focal male observations revealed that most males successfully paired, and a preliminary look at the nesting success data suggest that nests in CRP fields were at least as successful as those in shrubsteppe sites. *These data are preliminary: more detailed analysis and inclusion of additional data in 2004 may reveal different trends.*

Reptiles and Amphibians

Introduction

Our primary objective was to compare herptile distributions among the 6 site types. Pertinent response variables were presence and relative frequency of occurrence of each species (using raw counts and/or catch per unit effort estimates; cpu), species richness (number of species), and total abundance of all species combined.

Methods

We used two formal methods to generate cpu and community descriptor data; time – area constrained surveys, and drift fence – funnel trap arrays. To develop the most complete species lists possible for each plot, we also included incidental observation information from members of the herptile, bird, and small mammal field crews.

We initially intended to survey herptiles along transects (600 m x 2 m per plot). However, during flagging of transect routes (28.8 km total) and a brief pilot study during May and June, no herptiles were documented and this method was abandoned in favor of time – area constrained surveys.

We conducted time – area constrained surveys between 25 June and 27 August at the Black Rock, Chester Butte, Coyote Canyon, Jameson Lake, and Pacific Lake sites. We surveyed the Swanson Lake plot SLSC in place of PLSC, since this substitution created a tighter spatial cluster of (Pacific Lake) plots, saving a great deal of driving time, and since we did not survey the Swanson Lake sites during 2003. Individual surveys were 1.5 – 2.0 person-hrs duration depending on habitat complexity of individual plots, and were constrained within the 400 m x 400 m (16 ha) area delineated by flags marking 50 m distance beyond bird survey station centers (Fig. 3).

We visited most treatment plots twice; Jameson Lake sites were visited only once. We strove to visit each plot once in the morning and once in the afternoon, but distribution of plots occasionally forced us to deviate from this scheme. During surveys, we "high-graded" plots by searching first in areas containing optimal basking, den, forage, (etc.) habitat features for species potentially present, and then searching in progressively less optimal areas. In plots containing little vegetative or structural diversity, two observers covered the entire plot by walking a systematic zig-zag pattern while spaced a short distance apart.

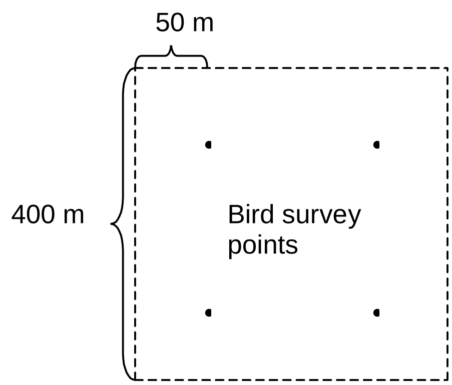

Figure 3. Boundary of time and area-constrained survey plots superimposed over bird point-count points (*drawing not to scale*).

We installed a single drift fence – funnel trap array in each Black Rock, Chester Butte, Coyote Canyon, and Pacific Lake plot, again substituting SLSC in place of PLSC. Arrays were located at plot center, as determined by averaging the UTM coordinates of the bird point count origins. Arrays were constructed in a 3-armed configuration with fence arms arranged 120^0 apart (Fig. 4). Each arm was 10 m length x ≈45 cm in height, was constructed of ≈1.5 mm mesh nylon window screen, and was buried to 10 – 15 cm depth along the entire bottom edge and held upright with wooden stakes. Funnel traps were constructed of the same material, and were located 0.5 m from array center and at the distal end of each fence arm. Central traps were double-funneled, while distal traps had funnels only in the inner end. When open, funnels contained soil and stones, and were shaded with micro-perforated landscaping cloth held in place by rocks. We used this cloth to stop funnel entrances when traps were not in use. Funnel traps were opened during 29 July – 15 August.

Upon observation, all herptiles were first identified to species before capture attempts were made. All herptiles captured (except venomous snakes) received a unique toe or caudal scale clip, were weighed and measured (snout-vent length; svl), and released near the point of capture. Shed snake skins found in plots were keyed to species when possible, and accepted in generation of species lists. Unidentifiable skins and tracks of snakes or lizards crossing dirt roads within plots were recorded as unidentified snake or lizard, and included in cpu estimates.

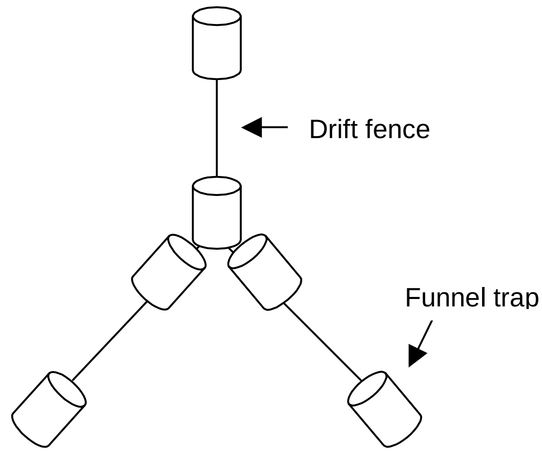

Figure 4. Drift-fence and funnel-trap array design (*drawing not to scale*).

Variable generation—Species lists were subjective and may have been biased by differing amounts of survey time spent among treatment types by bird surveyors, from which most incidental observations originated. However, incidental observations combined with formal methods resulted in the most complete species lists for plots, and will be valuable in evaluating relative efficiency of each formal method. Frequency of occurrence of species was assessed in two ways: raw counts pooled within treatment plots, and counts adjusted to cpu. In addition, number of species and total number of all herptiles observed were estimated within treatment plots.

Planned analyses are as follows. Observed distribution of each species among treatments will be evaluated against the H_o: of randomness. Goodness-of-fit of observed data to a Poisson distribution will be assessed via log-likelihood tests, while the H_o: of no difference in species richness and total abundance among treatments will be evaluated using Fisher's exact tests (Zar 1996).

Results

Time-area constrained search effort ranged from 15.2 hours in NC plots − 19.4 hours in SC plots. Funnel traps were opened for a total of 143 trap nights between 28 July and 15 August, with 23 – 24 trap nights of effort in each treatment type. We recorded 93 individuals representing 8 species (+1 unidentified snake) when data from all methods were pooled (Table 6). Area searches generated an average of 2.7 observations / 10 hrs, while funnel traps caught 1.4 herptiles / 10 trap nights.

Table 6. Frequency of occurrence of herptiles within treatment types, pooled among survey methods.

	Treatment						
	NC	NS	OC	OS	SC	SS	Total
Short-horned lizard	2	2	4	20	5	12	45
Western rattlesnake	0	1	0	2	1	18	22
Western skink	0	0	0	0	7	1	8
Gopher snake	0	1	0	1	0	5	7
Racer	0	0	0	0	1	5	6
W. terrestrial garter snake	1	0	1	0	1	0	3
Great-basin spadefoot toad	0	0	0	0	0	1	1
Long-toad salamander	0	0	0	0	0	1	1
UI snake	0	0	0	0	0	1	1
Total abundance	3	4	5	23	15	44	94
Number of species	2	3	2	3	5	8	8

Survey methods varied in effectiveness among species (Table 7). Short-horned lizards and gopher snakes were more frequently observed incidentally (n = 27 and 5, respectively) than during area searches (10 and 1, respectively) or by trapping (8 and 1, respectively). Western rattlesnakes were observed with similar frequency during area searches (11) and incidental sightings (10), and were rarely caught in funnel traps (1). Western skinks were more frequently caught in traps (6) than all other methods combined (2).

Summary results presented below are drawn from all observation methods pooled using raw count data, and are therefore not cpu-adjusted. Formal statistical analysis was not conducted on 2003 data. Short-horned lizards were both most abundant and widely distributed, and occurred in all treatment types. Short-horned lizards were observed in higher numbers in OS plots (n = 20), and SS plots (12), than remaining treatment types (≤5 for any treatment). In addition, short-horned lizards were the only species documented in NC plots. Western rattlesnakes were next most abundant, and were recorded 9x more frequently in SS plots (n = 18) than in any other single treatment type. Western rattlesnakes were never observed in NC or OC plots. Short-horned lizards and western rattlesnakes comprised 71% of all observations. Western skinks were recorded most frequently in SC plots (n = 7). No other species was observed more than five times in any single treatment type.

Total abundance of all species was higher in SS plots (n = 44) than in any other treatment type, and was next highest in OS plots (23), then SC plots (15), respectively. Species richness was highest in SS plots (n = 8) and SC and plots (5), with ≤3 species documented in any other treatment type.

Table 7. Frequency of occurrence of herptiles within survey methods, pooled among treatments.

	Survey Type				
	Area search	Funnel trap	Incidental obs[a]	incidental obs[b]	Total
Short-horned lizard	10	8	17	10	45
Western rattlesnake	11	1	1	9	22
Western skink	1	6	1	0	8
Gopher snake	1	1	2	3	7
Racer	2	2	1	1	6
W. terrestrial garter snake	1	1	0	1	3
Unidentified snake	0	0	0	1	1
Great-basin spadefoot toad	0	1	0	0	1
Long-toad salamander	0	0	0	1	1
Total abundance	26	20	22	26	94
No. Spp	6	7	5	7	8

[a] Herptile crew incidental observations
[b] Bird and mammal crew observations

Summary

Trends observed during 2003 for several species, total abundance, and species richness suggest that higher conservation value for Central Washington herptiles may be found in shrubsteppe habitats embedded within shrubsteppe landscapes than in other treatment types. Shrubsteppe plots in agricultural landscapes and old CRP plots embedded in shrubsteppe landscapes supported some, but not all of the species locally present. Old CRP plots within shrubsteppe landscapes had higher herptile total abundance than did shrubsteppe plots set in agricultural landscapes. New CRP plots within either landscape and old CRP plots in agricultural landscapes were depauperate of herptiles. *These data are preliminary: more detailed analysis and inclusion of additional data in 2004 may reveal different trends.*

Small Mammals

Introduction

As part of a larger investigation in the northern Columbia Basin ("Wildlife Communities in Shrubsteppe and Conservation Reserve Program (CRP) Lands in Eastern Washington"), we are comparing small mammal species composition and abundance among CRP and shrubsteppe habitat types. In this report we summarize our methods and report preliminary results and data status for our first year of sampling. We briefly discuss the main trends in our results so far. We suggest additions to the sampling protocols that would improve our understanding of variation in small mammal communities across these habitats.

Methods

Field—We planned field work for early summer, but initial sampling captured birds at a higher rate than expected. To avoid interference with the bird component of the study, trapping was halted after two clusters in summer and resumed in autumn when fewer birds were expected to be vulnerable to snap traps. We sampled the Jameson Lake (JL) and Chester Butte (CB) clusters during June 2003. Eight clusters were sampled during autumn (September 24 to November 1). This included the two clusters trapped during summer. These clusters were re-trapped because potential seasonal differences could bias comparisons of summer data with autumn results.

During summer, each site on the JL and CB clusters was sampled along 300-m transects, extending from permanent stations 1 to 2 and from 3 to 4 (Fig. 5). Each transect included 31 stations, spaced at 10-m intervals, and two Museum Special snap traps were placed at each station. Each site was trapped for a single 5-day period. The six sites in a block were trapped nearly simultaneously (all sites open on at least three of the same nights) to reduce effects of temporal variation on capture rates among treatments. Traps were open for 4 nights and checked during morning or early afternoon. Nominal trap effort per site was 496 trap nights (124 traps x 4 nights).

Summer 2003 sampling served as a pilot study, leading to adjustments in our sampling scheme for autumn. Mammal captures were very low on a few sites sampled during summer, and spatial variation between transects on a site was high. To expose more animals to capture and sample more of each site, we changed from two transects per site to four (Fig. 5). Two transects extended between permanent stations 1 and 4, and between 2 and 3. A supplemental transect ran parallel to each of these transects, spaced 50 m towards the site boundary. As in summer, each transect included 31 stations at 10 m intervals. To keep trap effort manageable with available resources, one trap was placed at each station. Transects were open for 4 nights, producing the same nominal trap effort as in summer (496 trap nights per site). As in summer each site was trapped for a single 5-day period, with nearly simultaneous sampling of sites within a block. We sampled 47 of the 48 study sites. One site (Block BR, site OC) was not sampled due to withdrawal of access by the landowner.

During both seasons, traps were baited with a mixture of peanut butter and rolled oats, and set within 1.5 m of the station. Traps were checked each of the following 4 days. Sprung, stuck, or missing traps were reset or replaced; bait was added as necessary; and dead animals were collected. Animals that were paralyzed or mortally wounded but still alive were euthanized with halothane and collected. A small percentage of animals were alive with minor injuries; these animals were given temporary marks with a Sharpie marker and released. Preliminary species identification was recorded for all animals in the field, and each was assigned a unique identification number. Animals were frozen until lab processing.

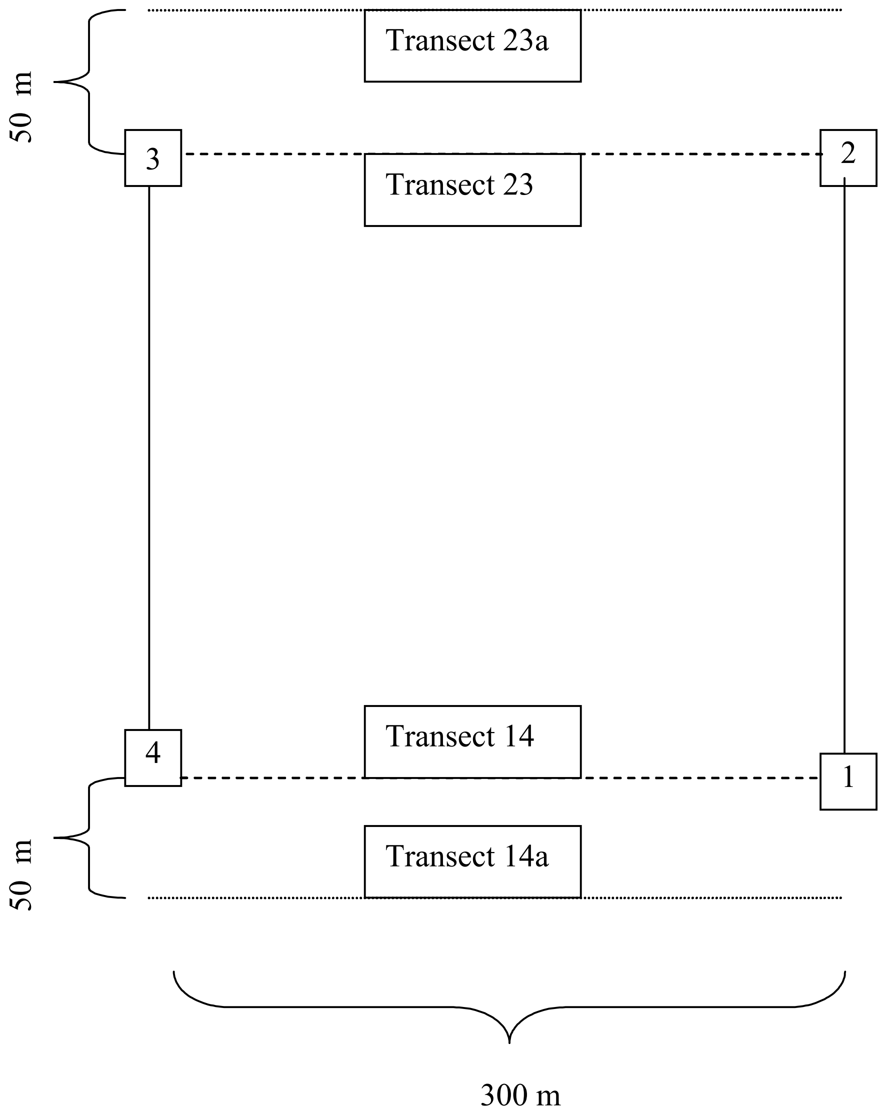

Figure 5. Schematic diagram of plot and transect layout. Boxed numbers (1, 2, 3, 4) indicate permanent site reference points (bird point-count stations). Snap trap transects are indicated by lines. Summer transects extended from points 1 to 2 and from 3 to 4. Fall transects extended from 2 to 3 and 1 to 4 (transects 14 and 23), with additional transects established parallel to these lines (14 and 23a).

Lab Curation—During lab processing, we recorded standard external measures (mass, total length, and lengths of tail, ear, and hind foot), sex, and reproductive information (size and condition of nipples or testes, size of seminal vesicles, size and number of embryos, and number of distinct placental scars on the uterine horns. Species were identified based on external characters and dental characteristics, following Ingles (1965), Verts and Carraway (1998), and Nagorsen (2002).

Current Data Status and Analysis

We report preliminary capture numbers by species and habitat type, but urge caution in interpreting these numbers. Although we report capture numbers (based on number of unique animals captured during 4 trap days per site), these data are 1 or 2 steps removed from results that will be used for statistical analysis. Capture numbers will be standardized as captures per 100 trap nights (Catch per unit effort; CPUE) to account for sprung, stuck, and missing traps, and those sprung by other species. For the deer mouse and perhaps additional species, we will examine whether capture probabilities vary by habitat. If such variation is present, abundance will be estimated for each site using removal estimators, and these estimates will be used for statistical comparisons (Skalski and Robson 1992). Verification of species identifications have been completed for most voles and shrews. Lab processing of specimens will continue during winter 2004, and final capture numbers will be verified when this is complete.

Results

During summer, we captured 204 small mammals during 5900 trap nights on two clusters (12 sites, Table 8). During autumn, we captured approximately 2100 small mammals during 23,000 trap nights on eight clusters (47 sites). Overall, we captured at least 10 small mammal species. Three species, the deer mouse, Great Basin pocket mouse, and western harvest mouse made up 90% of captures. The deer mouse was captured most frequently. Other species captured were the least chipmunk, sagebrush vole, montane vole, long-tailed vole, northern pocket gopher, Merriam's shrew, and vagrant shrew. An additional species, the meadow vole, has been preliminarily identified by dental characteristics during lab examinations. However, additional examination is needed for confirmation. Incidental captured of non-target taxa included 13 birds and one garter snake in summer and two tiger salamanders and one gopher snake in autumn.

Captures per site of all small mammal species varied widely (range 3-192 mammals per site), and increased from summer to fall overall and on the two clusters sampled in both seasons (for JL and CB clusters: summer mean = 17.1 individuals/site, median = 15; autumn mean = 37.2, median = 32). Except for the meadow vole, all small mammal species were captured in both seasons.

Table 8. Preliminary number of small mammals captured by species and study area during summer and autumn 2003.

Species by Sampling Period	Black Rock	Chester Butte	Coyote Canyon	Jameson Lake	Pine Canyon	Pacific Lake	Swanson Lake	Tracy Rock	Total
Summer Samples									
Merriam's shrew		0		1					1
Vagrant shrew		2		0					2
Least chipmunk		6		13					19
Northern pocket gopher		0		2					2
Great Basin pocket mouse		28		17					45
Deer mouse		38		82					120
Western harvest mouse		2		1					3
Sagebrush vole		5		6					11
Long-tailed vole		0		1					1
Montane vole		0		1					1
Autumn Samples									
Merriam's shrew	0	0	0	1	0	0	1	0	2
Vagrant shrew	0	14	0	0	0	0	0	6	20
Least chipmunk	0	4	11	13	2	0	6	8	44
Northern pocket gopher	0	0	1	0	0	1	1	0	3
Great Basin pocket mouse	49	49	73	30	53	43	14	14	325
Deer mouse	98	154	109	124	146	136	118	484	1369
Western harvest mouse	59	4	14	2	17	65	9	21	191
Sagebrush vole	6	13	6	12	13	33	12	17	112
Long-tailed vole	0	1	0	0	1	0	0	0	2
Montane vole	2	5	0	0	0	0	3	9	19
Meadow vole	0	0	0	0	0	1	0	1	2

Table 9. Preliminary mean (SE) number of individuals captured for common rodents by habitat condition during summer and autumn 2003. Sample size: summer *n* = two sites per habitat condition during summer; autumn *n* = seven for old CRP/cropland, *n* = eight for other habitat conditions.

Habitat/Landscape context	Least chipmunk	Northern pocket gopher	Great Basin pocket mouse	Deer mouse	Western harvest mouse	Sagebrush vole
Summer Sampling						
New CRP/Cropland	0.00 (0.00)	0.50 (0.50)	0.00 (0.00)	16.50 (10.50)	1.00 (1.00)	0.50 (0.50)
New CRP/Shrubsteppe	0.00 (0.00)	0.00 (0.00)	2.00 (2.00)	2.00 (2.00)	0.00 (0.00)	0.50 (0.50)
Old CRP/Cropland	0.00 (0.00)	0.00 (0.00)	3.00 (1.00)	14.00 (10.00)	0.00 (0.00)	1.50 (1.50)
Old CRP/Shrubsteppe	3.50 (3.50)	0.00 (0.00)	4.50 (1.50)	11.50 (5.50)	0.50 (0.50)	1.00 (1.00)
Shrubsteppe/Cropland	4.00 (1.00)	0.00 (0.00)	4.00 (1.00)	13.50 (5.50)	0.00 (0.00)	1.00 (0.00)
Shrubsteppe/Shrubsteppe	2.00 (1.00)	0.50 (0.50)	9.00 (2.00)	2.50 (0.50)	0.00 (0.00)	1.00 (0.00)
Autumn Sampling						
New CRP/Cropland	0.00 (0.00)	0.00 (0.00)	5.13 (1.73)	46.50 (21.14)	11.25 (6.09)	4.13 (1.44)
New CRP/Shrubsteppe	0.00 (0.00)	0.13 (0.13)	7.63 (3.04)	15.38 (4.19)	3.13 (1.95)	1.75 (1.10)
Old CRP/Cropland	0.00 (0.00)	0.00 (0.00)	7.14 (2.20)	40.71 (13.37)	3.86 (1.83)	3.86 (1.42)
Old CRP/Shrubsteppe	0.50 (0.38)	0.13 (0.13)	6.13 (1.78)	22.00 (5.82)	3.25 (1.51)	1.25 (0.84)
Shrubsteppe/Cropland	2.88 (1.44)	0.00 (0.00)	8.25 (1.49)	33.13 (9.98)	1.00 (0.57)	3.25 (1.58)
Shrubsteppe/Shrubsteppe	2.13 (1.14)	0.13 (0.13)	7.25 (1.62)	18.50 (4.55)	1.88 (0.74)	0.25 (0.16)

Three rodents (deer mouse, western harvest mouse, and sagebrush vole) showed trends toward higher average relative abundance in CRP fields than on shrubsteppe patches (Table 9). The Great Basin pocket mouse had similar captures across all habitat conditions. In contrast, least chipmunks were captured mainly in shrubsteppe habitats. Only three Merriam's shrews were captured, including two in CRP fields and one in shrubsteppe habitat. Most vagrant shrews were captured in a wetland area on CBSC. The northern pocket gopher was rarely captured, but we observed its excavations on most study sites.

Additional analysis and 2004 data are needed to compare abundances between old and new CRP fields and between sites in a shrubsteppe vs. cropland landscape context. Although mean abundance for deer mice, harvest mice, and sagebrush voles was higher in sites surrounded by cropland, this is driven by three sites (CBSC, TROC, and TRNC). The least chipmunk was present on only two CRP sites, both of which were older CRP fields in a shrubsteppe landscape context. We observed chipmunks in sagebrush stands within a few hundred meters of several other CRP grassland sites, but did not capture or see any individuals in these CRP fields.

Discussion

Although results are preliminary, contrasting occurrence across habitat types for two shrubsteppe species are of special interest. The sagebrush vole, although relatively uncommon, appeared to be more abundant on CRP sites than shrubsteppe habitats. This result is not surprising, because sagebrush voles are a steppe species. However, CRP fields, including relatively young grasslands, may support a non-trivial percent of Washington's current sagebrush vole population. In contrast, least chipmunks were present only on shrubsteppe sites and on two CRP sites with well-developed sagebrush stands. Again, this strong association with sagebrush and other shrubs is expected (Verts and Carraway 2001), but suggests that increasing shrub cover may increase suitability of CRP sites for least chipmunks.

The small mammal community provides an important prey base for predatory mammals, birds, and reptiles. Preliminary results indicate that CPR fields may help maintain this ecosystem role of small mammals. Captures of the three most abundant species (deer mouse, Great Basin pocket mouse, western harvest mouse) on CRP sites generally were similar to or higher than captures on shrubsteppe sites. However, we did not examine abundance of two larger rodents (northern pocket gopher and Washington ground squirrel, *Spermophilus washingtoni*) that may be more important than mice as prey items for larger hawks, badgers, etc. *These data are preliminary: more detailed analysis and inclusion of additional data in 2004 may reveal different trends.*

Plans for 2004

Field data collection for all 3 species groups will be repeated in 2004. In addition, the vegetation at all 48 study sites will be characterized so that we may further define the habitat relationships of wildlife in CRP and shrubsteppe communities. A third year of data collection in 2005 would be desirable but is contingent on additional funding.

Recommendations for 2004 Sampling

- Use Brewer's Sparrows and Savannah Sparrows for focal male studies; discontinue banding and observation of Vesper Sparrows and Grasshopper Sparrows.
- Double the number of sampling plots for herptiles within each treatment type for a net sample size of 8 plots per treatment (48 plots total).
- Increase the per-unit effort of area-searches and funnel trap effort for herptiles.
- With the help of a student volunteer, we are assessing the utility of adding a comparison of pocket mouse food habits (cheek pocket contents) across the study treatments. If a sufficient number of pocket mouse specimens have seeds and other items in their cheek pouches, it may be valuable to compare the major pocket items across treatments.
- To provide evidence that Merriam's shrew is not more widespread than indicated by snap trapping, a small number of pitfall traps could be ran on a few sites during the snap trap sessions.
- Trap for small mammals in a sample of cultivated croplands to further assess the value of CRP fields. We assume that CRP fields are supporting small mammals that are absent or in low abundance on adjacent active croplands. Even a few hundred trap nights on wheat fields, regardless of their growth stage, would provide some qualitative insight about this assumption.
- Our survey methods do not adequately sample northern pocket gophers or ground squirrels, reducing our insight into how the small mammal prey base varies across the habitats. Additional methods that may index abundance of these species, particularly methods that could be worked into existing sampling, should be considered.
- Sample the biological soil crust in a sample of plots in each treatment to assess the species present and relative stages of succession.

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Appendix. Common and scientific names of wildlife species mentioned in text.

Common Name	Scientific name
Birds	
Black-billed magpie	*Pica pica*
Brown-headed cowbird	*Molothrus ater*
Brewer's sparrow	*Spizella brewerii*
Brewer's blackbird	*Euphagus cyanocephalus*
Burrowing owl	*Athene cunicularia*
Cliff swallow	*Hirundo pyrrhonota*
Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbianus*
Common nighthawk	*Chordeiles minor*
Grasshopper sparrow	*Ammodramus savannarum*
Greater sage-grouse	*Centrocercus urophasianus*
Horned lark	*Eremophila alpestris*
House finch	*Carpodacus mexicanus*
Lark sparrow	*Chondestes grammacus*
Loggerhead shrike	*Lanius ludovicianus*
Long-billed curlew	*Numenius americanus*
Mourning dove	*Zenaida macroura*
Red-winged blackbird	*Agelaius phoeniceus*
Ring-necked pheasant	*Phasianus colchicus*
Rock wren	*Salpinctes obscoletus*
Sage sparrow	*Amphispiza belli*
Sage thrasher	*Oreoscoptes montanus*
Savannah sparrow	*Passerculus sandwichensis*
Say's phoebe	*Sayornis saya*
Vesper sparrow	*Pooecetes gramineus*
Western meadowlark	*Sturnella neglecta*
Herptiles	
Gopher snake	*Pituophis catenipher*
Great-basin spadefoot toad	*Scaphiopus intermontanus*
Long-toed salamander	*Ambystoma macrodactylum*
Northern leopard frog	*Rana pipiens*
Racer	*Coluber constrictor*
Sagebrush lizard	*Sceloporus graciosus*
Sharptail snake	*Contia tenuis*
Short-horned lizard	*Phrynosoma douglasii*
Striped whipsnake	*Masticophis taeniatus*
Tiger salamander	*Ambystoma tigrinum*
Western rattlesnake	*Crotalus viridis*
Western skink	*Eumeces skiltonianus*
Western terrestrial garter snake	*Thamnophis elegans*

Continued

Appendix (continued). Common and scientific names of wildlife species mentioned in text.

Common Name	Scientific name
Small mammals	
Deer mouse	*Peromyscus maniculatus*
Great Basin pocket mouse	*Perognathus parvus*
Least chipmunk	*Tamias minimus*
Long-tailed vole	*Microtus longicaudus*
Meadow vole	*Microtus pennsylvanicus*
Merriam's shrew	*Sorex merriami*
Montane vole	*Microtus montanus*
Northern pocket gopher	*Thomomys talpoides*
Sagebrush vole	*Lemmiscus curtatus*
Vagrant shrew	*Sorex vagrans*
Western harvest mouse	*Reithrodontomys megalotis*