

**Craters of the Moon National Monument
Breeding Bird Survey
1999**



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Executive Summary

Bird surveys were run on six point count transects during June and July of 1999. The surveys were performed on routes that were established and first surveyed in 1997. These six routes covered varying amounts of 17 of the 27 habitat types recognized at Craters of the Moon by Day and Wright(1985). There were a total of 712 individuals of 38 species observed on 77 point counts. The most numerous birds were Brewer's Sparrow, Spotted Towhee, Rock Wren, Mourning Dove, Mountain Bluebird, Clark's Nutcracker, Violet-green Swallow, and Chipping Sparrow. All other species had less than 25 total observations. The American Kestrel, Mourning Dove, Northern Flicker, Rock Wren, Violet-green Swallow, Sage Thrasher, Western Tanager, Green-tailed Towhee, Spotted Towhee, Vesper Sparrow, Chipping Sparrow, and Brewer's Sparrow were all recorded on 4 or more of the transects.

Over a quarter (10 of 38) of the species recorded are listed as sensitive by the state of Idaho, the BLM on adjacent lands, or are a Partners in Flight priority species. Nine of these are either shrub steppe or riparian associates indicating that Craters of the Moon continues to be a significant sanctuary for these habitats on the upper Snake River Basin.

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Craters of the Moon National Monument Breeding Bird Survey 1999

INTRODUCTION

Relatively undisturbed sites such as Craters of the Moon National Monument (CRMO) and the nearby Idaho National Engineering and Environmental Laboratory (INEEL) typically see much higher counts of shrubsteppe birds than more intensively managed lands. For example counts of Brewer's Sparrow are typically 3-4 per point on the INEEL and CRMO versus counts typically of 1-2 on BLM managed lands in the surrounding area (Jon Bart USGS, personal communication). Much of this decline has been the result of conversion of lands dominated by sagebrush to agriculture and grazing. Basin Big Sagebrush is the dominant shrub on the monument (Day and Wright 1985) and 99% of this shrub's range on the Snake River Plain has been eliminated or modified by agricultural use (Hironaka et al 1983).

Furthermore, nearly all of the habitats on the Snake River Plain have been invaded by exotic annual vegetation, primarily cheatgrass. Sagebrush sites that have high cheatgrass component in the understory have experienced an increase in fire frequency from 20-100 years to as little as 3-5 years (Peters and Bunting 1994). This change in the fire frequency has resulted in large areas devoid of native shrubs (Whisenant 1990). This trend is expected to continue in many areas, which will make undeveloped areas such as Craters of the Moon of even greater importance to migratory and breeding birds. Approximately 20% of the monument is shrubsteppe vegetation (Day and Wright 1985). This unique mix of sagebrush and recent lava flows exists in only two other locations in the United States (the area in and around Newberry Crater National Volcanic Monument in central Oregon and Lava Beds National Monument in Northern California). This has led the American Bird Conservancy and Idaho Partners in Flight to designate Craters of the Moon as an Important Bird Area (IBA) of national significance. IBA designation is based on specific criteria. In the case of CRMO these criteria include protection of several species of concern (defined as species which are threatened, endangered, sensitive, and declining), the site is an exceptional representative of a natural habitat, and the site supports long term monitoring. While having no legal status IBA designation is national recognition that CRMO preserves a significant portion of an important habitat.

Craters of the Moon National Monument was set aside to protect the unique geologic features of the Great Rift volcanic system. The monument has also preserved a unique ecosystem and provided an important refuge for sagebrush associated flora and fauna of the western United States. This role as an ecological sanctuary will only

increase in importance as surrounding lands are increasingly disturbed and modified. In light of this importance as an ecological sanctuary, it is important that long term avian monitoring continue. Monitoring of bird species began at Craters of the Moon in 1988 with the implementation of an annual bird survey, consisting of 34 sites located in 17 of the 26 vegetation types described in the monument (Day and Wright, 1985). This survey required an extensive effort in skilled staff and days in the field. Sites were widely dispersed and many required extensive travel by foot to reach, making it impossible to complete more than 2 sites a day by one individual. This survey was established primarily to measure habitat quality, using avian species diversity as an indicator.

The CRMO bird survey was revised for the 1997 field season. The earlier surveys had been designed to monitor habitat quality using birds as a model. The revised surveys were intended to more closely monitor bird populations. In the revised Standard Operating Procedure(SOP) monitoring habitat quality would come later with the implementation of the MAPS (Monitoring Avian Productivity and Survival) mist-netting program in the future. The MAPS program was designed to monitor productivity, survival, and recruitment which are key indicators of habitat quality. The bird survey for CRMO was based on the internationally used survey protocols defined by the North American Breeding Bird Survey (BBS) (USGS 1998). The BBS is sponsored by the United States Geological Survey's Biological Resources Division and the Canadian Wildlife Service and is used throughout North America. This standardization increases the statistical usefulness of data from CRMO and simplifies comparison with other areas whether protected or unprotected.

METHODS

The standard BBS protocol is a road based point count survey. This protocol had to be modified since a 25 mile driving route does not exist in the monument. Shorter routes were selected and include primary trails which are surveyed on foot. The loop road is surveyed by vehicle, but is only 4.7 miles in length from the VC to the point where the one-way loop ends (spur roads not included in survey).

The CRMO survey's SOP's recommend beginning the survey in mid-May after the arrival of the Brewer's Sparrow, and completing it by the end of June. In 1999 the above average snow pack was still present in many areas of the monument until late-May. Conditions were similar throughout most of the western US and normal spring migration was delayed throughout the western third of North America (John Bart personal communication). Many late phase migrants such as nighthawks, poorwills, and hummingbirds were not observed in the area until after June 20. As a result, the surveys did not begin until 06/23/99 and ended 07/02/98.

The survey consists of six routes (maps attached):

- 1 - LOOP DRIVE, starts at the gate at the beginning of the loop road and ends where the one-way loop ends.
- 2 - TREE MOLDS TRAIL, starts at the sign at the head of the trail.
- 3 - WILDERNESS TRAIL, starts at the sign at the head of the Broken Top/Wilderness trail.
- 4 - CAREY KIPUKA, starts at the north stake of the vegetation monitoring transect, circling the kipuka half way between the top of the kipuka and the edge of the lava flows in a counter-clockwise direction.
- 5 - NORTH END ROAD, starts where Goodale's Cut-off separates from Little Cottonwood road and follows the Little Cottonwood Creek past Martin Mine to the first switchback after the road becomes overgrown and undrivable.
- 6 - CAVES TRAIL, starts at the sign at the beginning of the caves trail and follows the trail to collapse at the Arco Tunnel entrance.

All surveys were conducted under acceptable environmental conditions as described in the BBS survey protocol (USGS 1998). Surveys begin 1/2 hour before sunrise. A measuring wheel was used to measure the distance between station stops on the walking routes at 250 meter intervals (825 feet). The odometer in the vehicle was used to measure the distance between station stops on the loop road at 500 meter (.31/mile) intervals.

The survey begins upon arrival to each station and lasts five minutes. A second individual was present to help keep time and record data, however, only the surveyor's observations were recorded. All birds heard or observed were recorded during each station stop. Birds detected were categorized as either over or under 50 meters or as flyovers. Flyovers are defined as birds that were flying over a surveyed area and are not associated with the immediate vegetative structures. Observations were further subdivided into those recorded in the first 3 minutes and 3 to 5 minutes. Birds flushed while in route between stations were also recorded. All transects were completed within 3.5 hours. When an individual bird was observed from nearby points it was counted at the first location only.

The vegetation types (Appendix 1) for each station were identified and recorded on the field form, using the Vegetation Types Map for reference. Bird species and numbers were then tabulated for routes and vegetation types.

RESULTS

A total of 21,250 meters were surveyed, consisting of 77 survey points, as listed in Table 1. The total number of individuals was 712 with the greatest number (283) on the wilderness trail and least (33) on the Caves Trails route (Table 1). The mean number of birds per point ranged from 6.6 to 11.3 with a mean of 9.2. The number of species recorded per transect ranged from 9 at Carey Kipuka to 25 at the North End. The total number of species observed on all transects was 38. The mean number of species per point ranged from 3.6 to 6.1 with an average for all sites of 5.1.

The Brewer's Sparrow had the greatest number (150) of individuals recorded. They accounted for 21% of all individuals recorded. Other species with total counts of 25 or more included Spotted Towhee ($n = 96$, percent of total = 13.5), Rock Wren ($n = 76$, % = 11.0), Mourning Dove ($n = 43$, % = 6.0), Mountain Bluebird ($n = 37$, % = 5.2), Clark's Nutcracker ($n = 31$, % = 4.4), Violet-green Swallow ($n = 32$, % = 4.5), Western Meadowlark ($n = 26$, % = 3.7) and Chipping Sparrow ($n = 25$, % = 3.5) (Table 2).

The Mourning Dove, Rock Wren, Violet-green Swallow, and Brewer's Sparrow were found on all six transects. The Northern Flicker, Mountain Bluebird, Sage Thrasher, and Spotted Towhee, were recorded on five of the six transects. Green-tailed towhees, Clark's Nutcracker, American Robin, Chipping Sparrow, Pine Siskin, and Western Tanager were recorded on four of the six transects.

Six species were recorded on 20 or more points. These were Brewer's Sparrow at 56 points (73% of total), Spotted Towhee at 49 points (64% of total), Rock Wren 38 at points (49% of total), Mourning Dove at 36 points (47% of total), Clarks Nutcracker at 28 points (36% of total) and Mountain Bluebirds were recorded at 26 points (34% of total).

Several species such as Sage Thrasher, Brewer's Sparrow, and Loggerhead Shrike were found only in shrubsteppe areas and in cinder gardens which contained shrub layers (Table 3). Other species such as the Spotted Towhee, American Robin, Mountain Bluebird were found in a much broader spectrum of habitats. The Northern Flicker, Clark's Nutcracker, Western Tanager, and the two finches which are considered forest birds while not always recorded at sites categorized as forest but were always observed in the immediate vicinity of trees if only isolated pines within the lava flows.

The riparian area around Little Cottonwood Creek not only had the highest number of species but also had several species that were not found elsewhere in the monument. These include Song Sparrow, Fox Sparrow, Warbling Vireo, and MacGillivray's Warbler. Incidental observations over the course of the year in both Little Cottonwood and Leech Creeks produce additional species not found elsewhere. These species include Plumbeous Vireo, Yellow Warbler, Blue Grouse, Cooper's Hawk, Sharp-shinned Hawk, Brown Creeper, Northern House Wren, Winter Wren, Gray Catbird, Lincoln's Sparrow. Several more species that were found throughout the monument were found in much higher numbers in the

riparian strip. This group consists of birds such as woodpeckers, finches, jays, owls and other forest birds.

Of all vegetation types lava flows were surveyed on the highest percentage of points (46% of points surveyed some lava flows)(Table 4). Other vegetation types that were surveyed on more than 10 percent of the points were Cinder Gardens (36%), antelope bitterbrush (27%), and Limber Pine/Bitterbrush (35%). Although no single type of sagebrush community was monitored on more than ten percent of points this general category consists of 12 different types and collectively accounted for the highest percentage of points. Of the more general community types lavas (flows and cinders) were monitored on 53% of points, shrubsteppe on 62%, grasslands on 4%, forests on 42%, and the developments on 1% of points.

Table 1. Craters of the Moon National Monument's 1999 Breeding Bird Survey route summary

ROUTE	LENGTH (m)	# of stops	habitat types	# of indv. (N)	avg. birds per point	# of species on transect	avg. species per point
Walking Routes							
Wilderness Trail	6000	25	1, 2, 6, 7, 16, 21, 22	283	11.3	21	6.1
Tree Molds	1750	8	2, 16, 22	75	9.4	11	5.4
Caves Trail	1000	5	1, 2, 21	33	6.6	12	3.6
Carey Kipuka	2250	10	2, 8, 9, 11	66	6.6	9	4.0
North End Road	3250	14	4, 5, 7, 18, 20, 24, 25, 26	97	6.9	25	4.1
Driving Route							
Loop Drive	7000	15	1, 2, 4, 16, 21, 22, 27	158	10.5	21	5.9
TOTALS	21250	77		712	9.2	38	5.1

Habitat Codes:

- 1 = Cinder Gardens
- 2 = Low Vegetation Density Lava Flows
- 4 = Mountain Big Sagebrush/Bluebunch Wheatgrass
- 5 = Mountain Big Sagebrush/Sandberg Bluegrass
- 6 = Mountain Big Sagebrush/Needlegrass
- 7 = Mountain Big Sagebrush/Needle-and-thread/Cheatgrass
- 8 = Mountain Big Sagebrush/Idaho Fescue
- 9 = Big Sagebrush/Cheatgrass
- 11 = Three-tip Sagebrush/Idaho Fescue
- 18 = Bluebunch Wheatgrass/Idaho Fescue
- 20 = Great Basin Wildrye
- 21 = Limber Pine/Bitterbrush (low total cover)
- 22 = Limber Pine/Bitterbrush (high total cover)
- 23 = Limber Pine/Bitterbrush (high density Limber Pine)
- 24 = Douglas-fir/Mountain Snowberry
- 25 = Upland Quaking Aspen
- 26 = Riparian
- 27 = Visitor Center and Residences

Table 2. Species recorded during 1999 Breeding Bird Survey

Species	No. of birds	% of total	Rts. detected on	# of stops	% of stops
Turkey Vulture	2	<0.01	LP	1	1.3
Northern Harrier	1	<0.01	NE	*	*
Mourning Dove	43	6.0	NE, LP, TM, CK, WT, CA	6	9.1
Common Poorwill	7	0.01	NE	*	*
Common Nighthawk	6	0.01	LP, CA	2	2.6
Lewis Woodpecker	1	<0.01	WT	1	1.3
Northern Flicker	19	2.7	NE, LP, TM, CK, WT	14	23.4
Hairy Woodpecker	1	<0.01	NE	1	1.3
Eastern Kingbird	1	<0.01	WT	1	1.3
Say's Phoebe	1	<0.01	LP, WT	2	2.6
Violet-green Swallow	32	4.5	NE, LP, CK, WT, TM, CA	8	10.4
Clark's Nutcracker	31	4.4	LP, WT, TM, CA	8	10.4
Common Raven	3	<0.01	CK, CA	3	3.9
Black-capped Chickadee	1	<0.01	NE	1	1.3
Red-breasted Nuthatch	1	<0.01	WT	1	1.3
Rock Wren	76	10.7	NE, LP, TM, CK, WT, CA	39	50.6
Blue-gray Gnatcatcher	3	<0.01	WT	1	1.3
Mountain Bluebird	37	5.2	LP, TM, WT, NE, CA	26	33.8
American Robin	16	2.2	NE, TM, LP, WT	13	16.9
Loggerhead Shrike	3	<0.01	CK	3	3.9
Sage Thrasher	18	2.5	NE, LP, CK, WT, CA	17	22.1
Warbling Vireo	2	<0.01	NE	2	2.6
Orange-crowned Warbler	2	<0.01	NE, WT	2	2.6
MacGillivray's Warbler	2	<0.01	NE	1	1.3
Lazuli Bunting	12	1.7	NE	9	11.7
Green-tailed Towhee	12	1.7	NE, LP, TM, WT	11	14.3
Spotted Towhee	96	13.5	NE, LP, TM, WT, CA	49	63.6
Song Sparrow	1	<0.01	NE	1	1.3
Chipping Sparrow	25	3.5	NE, LP, TM, WT	14	18.2
Brewer's Sparrow	150	21.1	NE, LP, TM, CK, WT, CA	55	71.4

* Common Poorwill and Northern Harrier seen between points but not observed during actual count

Route codes: NE = North End Road LP = Loop Road TM = Tree Molds Trail CK

= Carey Kipuka WT = Wilderness Trail

Table 2. Species recorded during 1999 Breeding Bird Survey

Species	No. of birds	% of total	Rts. detected on	# of stops	% of stops
Fox Sparrow	1	<0.01	NE	1	1.3
Black-headed Grosbeak	1	<0.01	LP	1	1.3
Western Meadowlark	26	3.6	CK	10	13.0
Brewer's Blackbird	12	1.7	NE, LP, WT	7	9.1
Brown-headed Cowbird	1	<0.01	LP	1	1.3
Western Tanager	17	2.4	NE, LP, WT, CA	12	15.6
Pine Siskin	11	1.5	NE, LP, WT, CA	6	7.8
Cassin's Finch	2	<0.01	NE, WT	2	2.6

Route codes: NE = North End Road LP = Loop Road TM = Tree Molds Trail CK
 = Carey Kipuka WT = Wilderness Trail

Table 3 Species list recorded by vegetation type.

VEGETATION TYPE		LAVAS		SHRUB-STEPPE COMMUNITIES								FORESTED						OTHER
SPECIES	STATUS	1	2	4	6	7	8	9	11	16	20	21	22	23	24	25	26	27
Turkey Vulture													X					
Northern Harrier	B			X														
Mourning Dove		X	X	X	X	X	X	X	X	X		X	X					
Common Poorwill															X			
Common Nighthawk			X										X					
Lewis' Woodpecker	P,B												X					
Northern Flicker					X		X			X		X	X	X	X			X
Hairy Woodpecker															X			
Eastern Kingbird																		X
Say's Phoebe		X																
Violet-green Swallow		X	X			X		X	X			X	X			X		
Clark's Nutcracker		X			X					X		X	X	X				
Common Raven			X															
Black-capped Chickadee															X			
Red-breasted Nuthatch										X								
Rock Wren	P	X	X	X	X													
Mountain Bluebird		X	X							X		X	X				X	X
American Robin													X	X		X	X	X
Blue-gray Gnatcatcher													X					
Loggerhead Shrike	P,I						X											

Status column codes: P = Idaho Partners in Flight priority species recommendation
 I = Idaho Department of Fish and Game species of special concern
 B = US Bureau of Land Management sensitive species

For vegetation codes see appendix 1

Table 3 Species list recorded by vegetation type cont.

VEGETATION TYPE		LAVAS		SHRUB-STEPPE COMMUNITIES								FORESTED						OTHER
SPECIES	STATUS	1	2	4	6	7	8	9	11	16	20	21	22	23	24	25	26	27
Sage Thrasher	P	X		X	X		X		X	X		X						
Warbling Vireo				X														
Orange-crowned Warbler													X					
MacGillivray's Warbler	P,B																X	
Lazuli Bunting				X													X	
Green-tailed Towhee	B	X	X	X	X					X			X	X			X	
Spotted Towhee		X		X	X					X	X	X	X		X		X	
Song Sparrow																	X	
Chipping Sparrow												X	X	X	X			X
Brewer's Sparrow	P,B	X		X	X		X	X	X	X			X					
Fox Sparrow																	X	
Black-headed Grosbeak													X					
Western Meadowlark	P						X	X	X									
Brewer's Blackbird													X					
Brown-headed Cowbird																		X
Western Tanager	P				X					X		X	X	X	X			
Pine Siskin		X										X	X	X	X			
Cassin's Finch													X		X			

Status column codes: P = Idaho Partners in Flight priority species recommendation
 I = Idaho Department of Fish and Game species of special concern
 B = US Bureau of Land Management sensitive species

For vegetation codes see appendix 1

Table 4. Vegetation types included on the Craters of the Moon Breeding Bird Survey routes.

Vegetation Types	Number of Stops per route						Ttl	% of stops
	LP	TM	WT	CK	NE	CA		
Lavas							41	53.2
1	10	-	17	-	-	1	28	36.4
2	9	5	6	10	-	5	35	45.5
Sagebrush							48	62.3
4	2	-	-	-	14	-	16	20.8
5	-	-	-	-	1	-	1	1.3
6	-	-	9	-	-	-	9	11.7
7	-	-	1	-	1	-	2	2.6
8	-	-	-	10	2	-	12	15.6
9	-	-	-	10	-	-	10	13.0
11	-	-	-	10	-	-	10	13.0
16	2	5	13	-	-	-	21	27.3
Grasses							3	3.9
18	-	-	-	-	2	-	2	2.6
20	-	-	-	-	1	-	1	1.3
Forests							32	41.6
21	2	-	-	-	-	1	3	3.9
22	8	7	9	-	-	-	24	31.2
23	-	-	1	-	-	-	1	1.2
24	-	-	-	-	1	-	1	1.3
25	-	-	-	-	3	-	3	3.9
26	-	-	-	-	12	-	12	15.6
Developed							1	1.2
27	1	-	-	-	-	-	1	1.2

LP = Loop Road CK = Carey Kipuka WT = Wilderness Trail
 NE = North End Rd TM = Tree Molds Trail CA = Caves Trail

Note - The total number of stops on each trail totaled 77, and that is the number used above to figure % of stops. However, the total number of stops in the vegetation types listed above is greater due to the multiple vegetation types present at a number of the stops.

CONCLUSION

The total number of birds observed in 1999 was 712. This was a 25% increase over 1998 (n=569) and a 113% increase over 1997 (n=335) (fig. 1). The number of species observed showed a different pattern with an increase from 1997 to 98 and then a decrease in 1999 (fig. 2). This was only the third year of monitoring on these routes so it is difficult to interpret these numbers in terms of any trends that may or may not be present. Difficulty in interpreting short term results is particularly influenced by the tremendous year to year variability in weather patterns at CRM0. For example the prevailing weather conditions were very different in each of the 3 years these surveys have been done. Temperatures and precipitation levels were below normal during the spring of 1997. Conversely the temperatures were close to the 40 year average throughout winter and spring of 97-98 but precipitation was well below normal in early winter rising to more twice the average amount in May and June. The winter of 1999 saw near average temperatures throughout the winter but the snow levels especially in the last half of the winter were high with snow accumulation approximately 150% of normal at the end of March. Snow thaw was prolonged with snow remaining into May and June in some areas. The North End survey route still had a few small snowdrifts along the route during the survey on July 2nd. These conditions may have led to very different vegetative conditions during the breeding season for many species. These weather patterns were likely in part responsible for a delay in the arrival of many long distance migrants in 1998 and 99. Much of the western US recorded high to record snow levels with a prolonged thaw. This regional weather pattern was likely in part responsible for a delayed or prolonged spring migration as observed throughout western North America during 1999 (Jon Bart, personal communication).

None of the 38 bird species observed during the 1999 surveys are on either the federal or state endangered species lists. However, of these 38 species, 10 of the species have been listed as a priority species by Idaho Partner's in Flight (IDPIF 1998), are listed by the Idaho Department of Fish and Game (IDFG 1998) as species of special concern, or as sensitive by the US Bureau of Land Management (USBLM 1998) on lands adjacent to the monument.

In this portion of their range all but one of these 10 are primarily associated with either shrubsteppe or riparian areas. The most abundant bird species are in one or more of these sensitive categories. This includes the most numerous species on the monument, the Brewer's Sparrow. Most of these species have experienced substantial declines in either part or all of their range including the Snake River Plain.

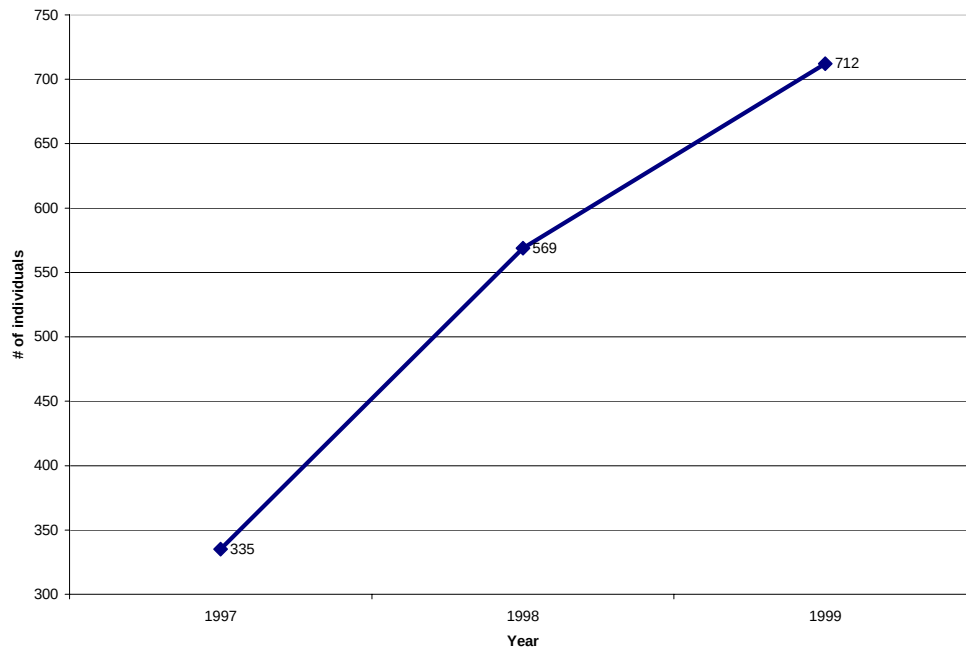


Figure 1. Numbers of birds recorded during breeding bird surveys 1997-99

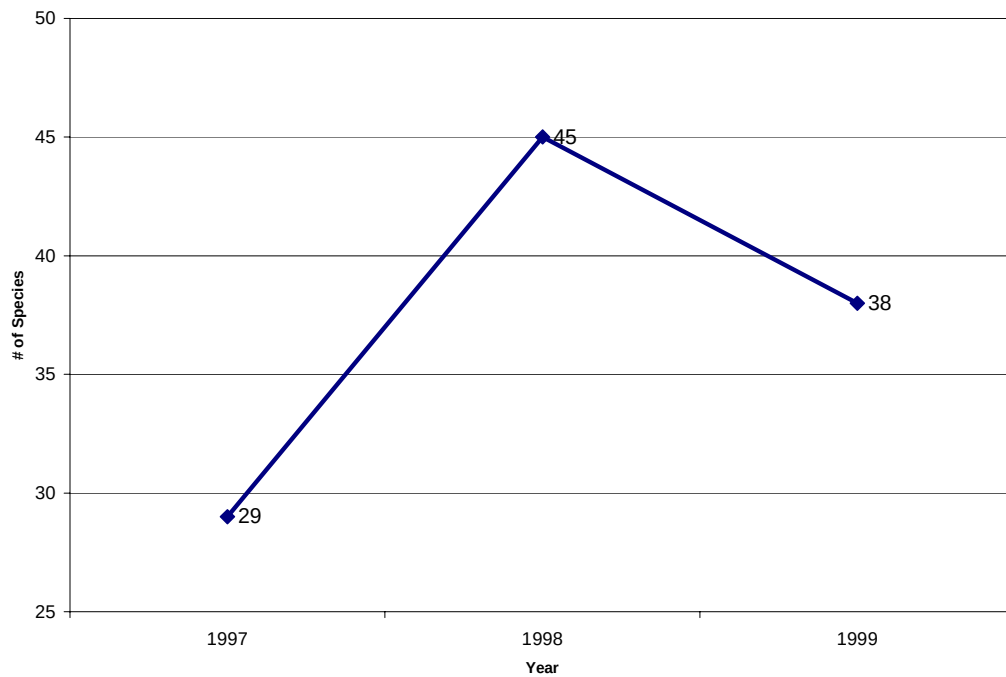


Figure 2. Number of species detected during breeding bird surveys 1997-99.

Recommendations

If we are to maintain natural faunal communities it is important that we know what species are here and their relative abundance and any trends in their population. This type of information can be gathered using the point count techniques of the breeding bird survey.

To maintain healthy populations we also need to know information regarding distribution, productivity, survival, recruitment and other individual and population characteristics. This type of information is not readily available from point counts and needs to be gathered using other techniques. Yet the need for this type of information will become increasingly important in the future. As it is likely that shrubsteppe will become even more fragmented on the Snake River Plain.

We also need to address the effects on wildlife of plant succession (as a result of fire suppression) in aspen communities as they continue to age and decline. Additionally, what are the effects of the mistletoe eradication program as killed trees begin to fall and snag recruitment in the population is significantly reduced due to loss of older trees during the 1960s? This program created a high number of snags for several years but has reduced the capacity for snag recruitment in the future. Could these factors produce an ecological sink where marginal habitat attracts large numbers of birds which either don't breed or nest success is very low? Such an area may actually have deleterious affect on long term populations in spite of apparent high numbers. The Monitoring Avian Productivity and Survival (MAPS) program is designed to answer these types of demographic questions about bird populations. The National Park Service is a cooperator in this joint effort and the information gathered has the potential to produce much useful information for the management of the avian component of the wildlife resources at Craters of the Moon National Monument. This expansion of monitoring was recommended in the 1997 Standard Operating Procedures but was never implemented due to budget and personnel constraints. It is recommended that this additional monitoring be implemented as soon as feasible.

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Appendix 1.

Craters of the Moon National Monument
Vegetation Types

LAVAS

- 1 Cinder Gardens**
- 2 Low Vegetation Density Lava Flows**
- 3 Medium Vegetation Density Lava Flows

SAGEBRUSH COMMUNITIES

- 4 Mountain Big Sagebrush/Bluebunch Wheatgrass**
- 5 Mountain Big Sagebrush/Sandberg Bluegrass**
- 6 Mountain Big Sagebrush/Needlegrass**
- 7 Mountain Big Sagebrush/Needle-and-thread/Cheatgrass**
- 8 Mountain Big Sagebrush/Idaho Fescue**
- 9 Big Sagebrush/Cheatgrass**
- 10 Complex of 4 and 8
- 11 Three-tip Sagebrush/Idaho Fescue**
- 12 Early Low Sagebrush/Idaho Fescue
- 13 Low Sagebrush/Sandberg Bluegrass
- 14 Low Sagebrush/Idaho Fescue
- 15 Complex of 13 and 14

OTHER SHRUB COMMUNITIES

- 16 Antelope Bitterbrush**
- 17 Antelope Bitterbrush/Great Basin Wildrye

GRASSLANDS

- 18 Bluebunch Wheatgrass/Idaho Fescue**
- 19 Bluebunch Wheatgrass/Sandberg Bluegrass
- 20 Great Basin Wildrye**

FOREST COMMUNITIES

- 21 Limber Pine/Bitterbrush (low total cover)**
- 22 Limber Pine/Bitterbrush (high total cover)**
- 23 Limber Pine/Bitterbrush (high density Limber Pine)**
- 24 Douglas-fir/Mountain Snowberry**
- 25 Upland Quaking Aspen**
- 26 Riparian**

DEVELOPED AREAS

- 27 Visitor Center and Residences**

Bold = Vegetation types present in the BBS routes

Appendix 2.

Precipitation (inches) and average monthly temperature values (degrees Fahrenheit) at Craters of the Moon National Monument for the 1996-1997 winter and spring seasons compared to the 40 year average. Taken from National Weather Service database for Craters of the Moon.

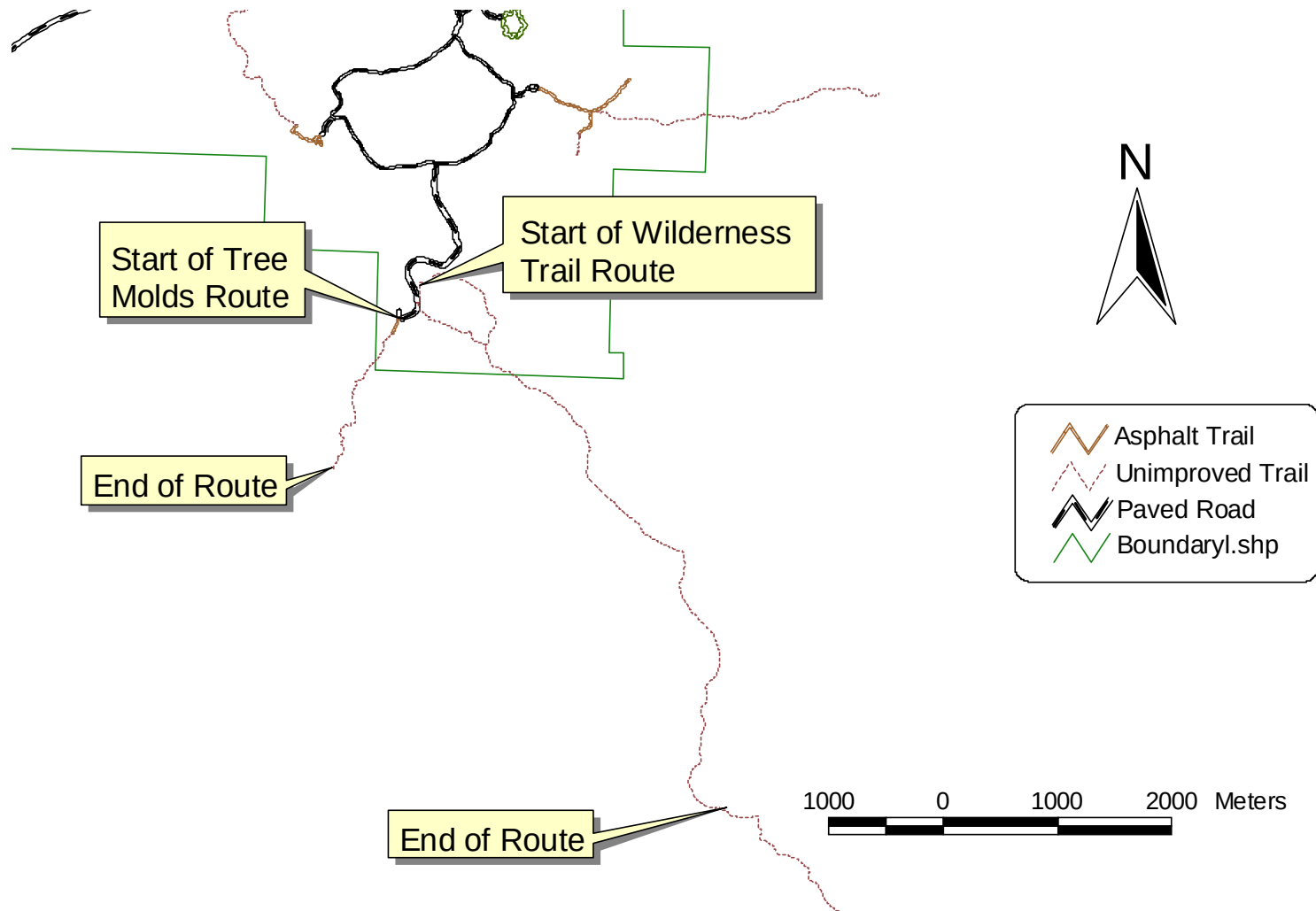
Precipitation (Inches)

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
40 yr ave	1.34	1.85	2.16	1.49	1.31	1.05	1.74	1.32
96-97	2.33	4.25	2.12	.02	.02	.66	.35	1.46
97-98	0.82	0.53	2.57	2.71	1.42	1.31	3.49	3.30
98-99	3.93	0.95	2.91	5.53	0.38	1.05	2.29	0.70

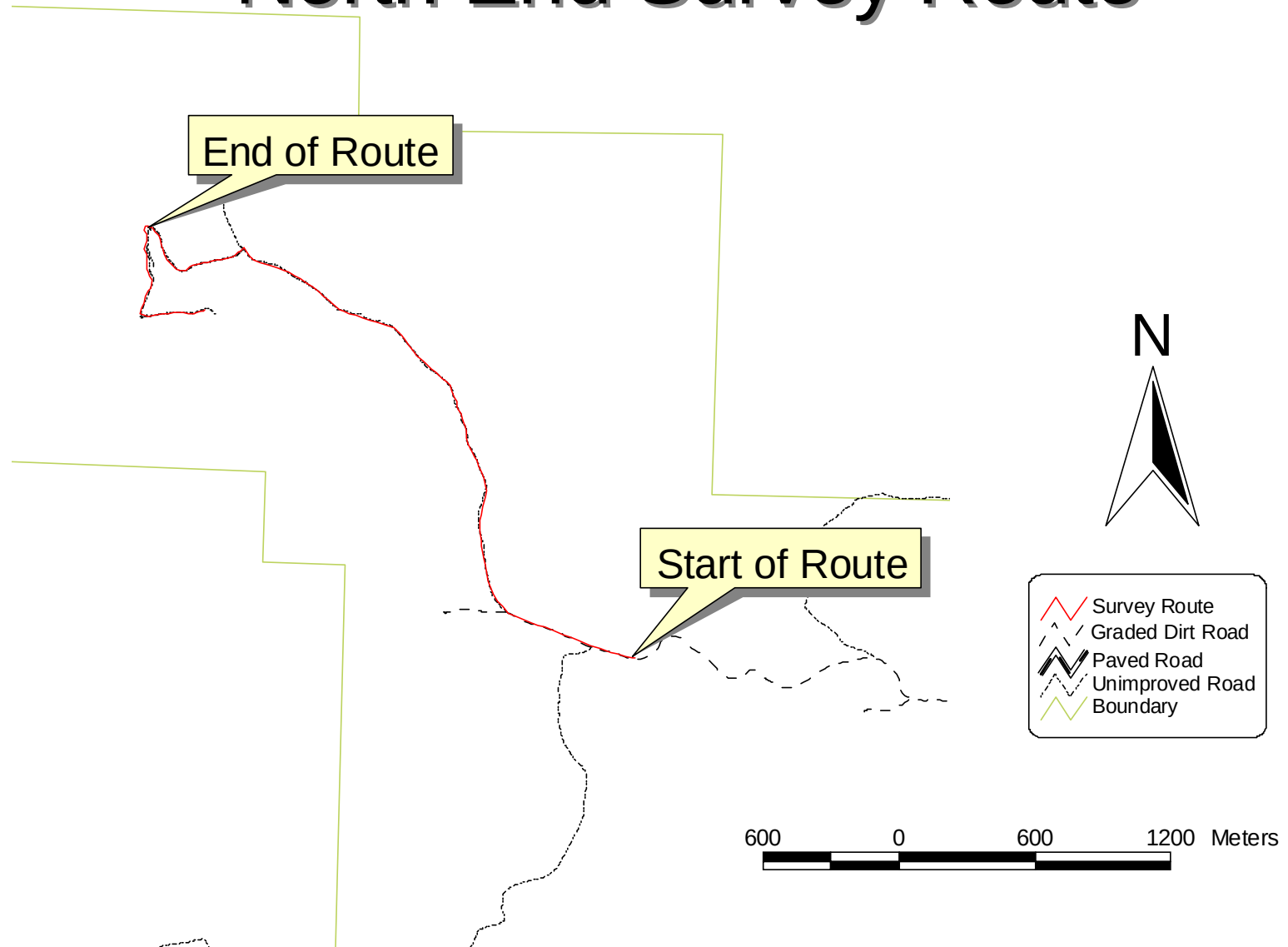
Temperature (Fahrenheit)

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
40 yr ave	30.4	20.6	19.6	24.0	31.0	40.6	50.7	59.5
96-97	34.1	22.2	20.8	25.0	35.6	40.0	56.3	61.2
97-98	32.4	20.8	25.6	26.6	29.2	41.9	50.2	55.6
98-99	30.1	18.1	22.8	21.7	30.0	39.4	47.3	58.7

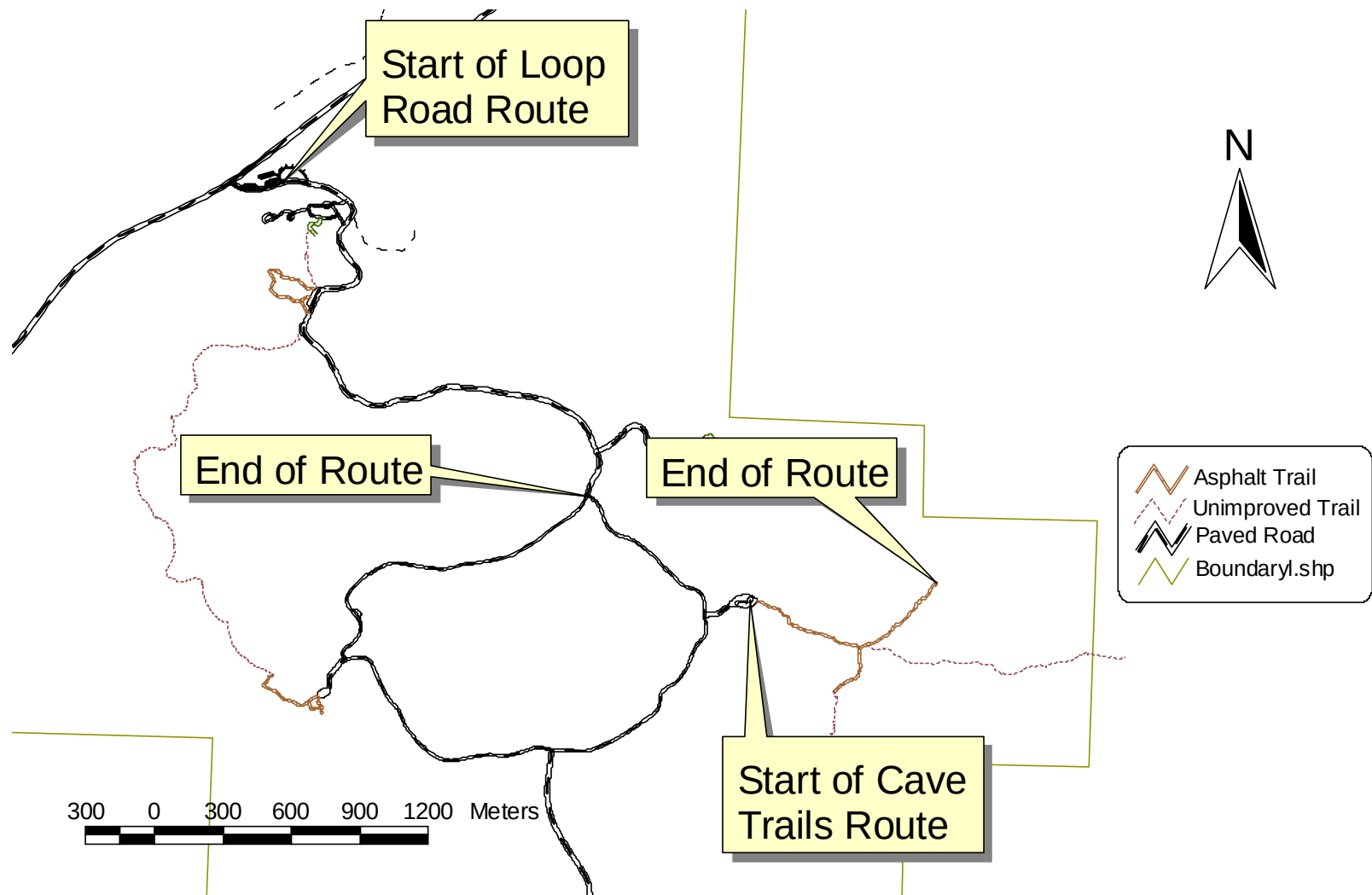
Tree Molds and Wilderness Trail Survey Routes



North End Survey Route



Loop Road and Caves Trail Routes



Carey Kipuka Survey Route

