

NATIONAL NATURAL LANDMARK EVALUATION

Craters of the Moon National Monument and Preserve (IDAHO)

Columbia Plateau Natural Region

Low Sagebrush Theme

Low Sagebrush/Idaho Fescue Subtheme

April 2004

prepared for

U.S. Department of the Interior
National Park Service

by

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INTRODUCTION

In his early theme study Daubenmire (1975), proposed several "zones" that contain low sagebrush (*Artemisia arbuscula*) and early low sagebrush (*Artemisia longiloba*) biotic communities. In Phase I of the current study (The Nature Conservancy et al. 1989), however, all low sagebrush and early low sagebrush communities were treated as one separate Low Sagebrush Theme. To best include the diversity of the Low Sagebrush Theme in the NNL registry, two subthemes were identified: Low Sagebrush/Bluebunch Wheatgrass (*Agropyron spicatum*) and Low Sagebrush/Idaho Fescue (*Festuca idahoensis*). This report evaluates a potential NNL site to represent the Low Sagebrush/Idaho Fescue Subtheme.

In Phase II of the current study (Crawford et al. 1989), five Low Sagebrush/Idaho Fescue sites from Oregon and Idaho were evaluated on the basis of illustrative character, condition, diversity, rarity, and value for science and education. Sites evaluated were Craters of the Moon National Monument and Preserve (ID), Toppin Creek Butte (OR), Triplet Butte (ID), Brass Cap Kipuka (ID), and Shaketable Mountain (OR). Through the Phase II evaluation, Craters of the Moon National Monument and Preserve was selected as the best example of this subtheme.

SITE CHARACTERISTICS

Location

Craters of the Moon National Monument and Preserve lies on the northern edge of the eastern Snake River Plain, Blaine and Butte counties, Idaho. The proposed NNL (PNNL) occurs in two units, occurring on the western and northern edges of the Monument (Figures 1, 2, and 3). Lands within the PNNL boundary lie within Township 2 North, and Range 24 East (North Unit) and Township 1 South, and Range 24 East (South Unit). U.S. Geological Survey topographic map coverage is available on the Inferno Cone (North Unit) and Little Park (South Unit), 1972 7.5' quadrangles. The North Unit is also covered on the 1957 Craters of the Moon National Monument and Preserve 1:31,680-scale U.S.G.S. topographic map. The Craters of the Moon Quadrangle Surface Management Status map, 1:100,000-scale series, published by the BLM also provides coverage.

The site lies about 31 km (19 miles) east of Carey, Idaho. Access to the North Unit of the PNNL is via a dirt road that intersects U.S. Highway 20/26/93, about 0.8 km (0.5 mile) northeast of the Monument Information Center. Proceed northwesterly on this road for about 5.6 km (3.5 miles), up Little Cottonwood Creek to the end of the road. A short walk upslope to the ridge brings you to the North Unit. Permission from the Superintendent of the National Monument is needed to travel on the road to Little Cottonwood Creek.

The South Unit is accessed via a series of dirt roads that begin at the intersection of the Carey-Kimama Desert Road and U.S. Highway 20/26/93, about 6.4 km (4 miles) northeast of Carey. Proceed about 8 km (5 miles) east on the Carey-Kimama Desert Road, a well maintained, all-weather, gravel road, to Paddleford Flat. At the intersection of the Carey-Kimama Desert Road and the Laidlaw Park Road, proceed east on the Laidlaw Park Road. A choice of two routes, each requiring a hike of equal distance across rough lava, is available. The first is via a dirt road that heads northeast in Little Park from the Laidlaw Park Road about 11 km (7 miles) from its intersection with the Carey-Kimama Desert Road. Proceed to the end of this road in Section 25, T1S, R23E. Walk east a short distance to the top of a small knoll, where Carey Kipuka (the South Unit of the PNNL) can be seen across the lava to the north. A short, but rough hike north across the lava will bring you to the PNNL. The second access point is gained by proceeding on the Laidlaw Park Road another 5 km (3 miles) to Laidlaw Park. Turn east at the first intersection, which eventually heads north along the west side of Laidlaw Park to the end of the road in Section 20, T1S, R24E. Follow a faint trail west to Carey Kipuka, the South Unit of the PNNL. Several intersections are passed along both routes, and the Craters of the Moon Surface Management Status map should be consulted frequently.

Four-wheel-drive is not necessary if either road is traveled in the dry season. More specific directions should be obtained from the Information Center at Craters of the Moon National Monument and Preserve.

Boundary

A boundary was chosen to encompass the range in diversity of the low sagebrush (*Artemisia*

arbuscula) and early low sagebrush (*Artemisia longiloba*) communities in Craters of the Moon National Monument and Preserve. It is the minimum boundary required to include an adequate representation of features of the subtheme. The boundary of the North Unit follows the limits of low sagebrush communities on the ridges lying west, north, and east of the Little Cottonwood Creek canyon. The boundary of the South Unit follows a major landscape feature, the edge of the recent lava flows that surround Carey Kipuka.

The two units of the proposed Craters of the Moon National Monument and Preserve NNL are separated by about 17.7 km (11 miles), and lie in the following sections:

North Unit - T2N, R24E, Sections 16, 20, 21, 22, 23, 24, 26, 27, 28, 32, 33, and 34.

South Unit - T1S, R24E, Sections 19 and 20.

The boundary of the North Unit of the PNNL is as follows: Beginning where the Monument boundary crosses from lava upslope in Section 24 follow the edge of lava to where the Monument boundary crosses from upslope to lava in Section 32. The PNNL boundary then follows the Monument boundary north to the 7100 foot contour in the Cottonwood Creek drainage. The boundary follows the contour to the draw at the head of the tributary drainage, then proceeds straight upslope, across the saddle divide of Cottonwood Creek and Lava Creek to the 7100 contour within the Lava Creek drainage. The PNNL boundary follows the 7200 foot contour to the western edge of Section 16. It then travels along the section line to a line constituting the southern one-quarter of Section 16 (i.e., the old Monument boundary). The PNNL boundary continues due east to the 7100 foot contour of the Lava Creek drainage to the eastern edge of Section 15. The boundary proceeds south along the eastern edge of Section 15 and 16 to the Monument boundary. The PNNL boundary then follows the Monument boundary to the beginning point.

The boundary of the South Unit of the PNNL is coincidental with the boundary of Carey Kipuka, which is defined by the distinct contact between recent lava of the Craters of the Moon Lava Field and the older lava of the kipuka.

Size

The total area contained within the PNNL is estimated to be 1626.5 ha (4019.1 acres); 1557.1 ha (3847.7 acres) in the North Unit and 69.3 ha (171.4 acres) in the South Unit. Area was computed using a geographical information system software.

Description

Craters of the Moon National Monument and Preserve lies at the northern edge of the Snake River Plain, a large, relatively flat volcanic surface that bisects southern Idaho. The Monument encompasses the most diverse and geologically recent part of the Plain, and part of the adjacent foothills of the Pioneer Mountains. The PNNL is comprised of two units; the North Unit encompasses low sagebrush communities on a ridge system in the Pioneer foothills, at the north end of the Monument, and the South Unit encompasses Carey Kipuka, surrounded by the Craters of the Moon Lava Field at the southwest corner of the Monument.

Geology of the PNNL is largely of volcanic origin; however, the two units differ widely in age and rock-type. The North Unit is mostly composed of undifferentiated volcanic rocks, predominantly latite and andesite conglomerate, of the Tertiary Challis Volcanics. A small area of this unit, is underlain by Tertiary quartz monzonite (Rember and Bennett 1979). Although it is difficult to tell from available maps, Carey Kipuka (the South Unit) is probably underlain by Quaternary Snake River Basalt similar to that of Little Park (Rember and Bennett 1979). It is surrounded by aa lava of the Carey Kipuka and Little Park flows, which are presumed to have emanated from Silent Cone about 6,600 years ago (Kuntz et al. 1982).

Climate of the upper Snake River Plain is best characterized as continental, modified somewhat by marine air from the Pacific. It is semiarid with typical intermountain characteristics of hot dry summers and cold winters with precipitation occurring principally as snow during the winter and rain during the spring and fall. Summer precipitation is generally sparse and ineffective. These generalizations are borne out by precipitation and temperature records from Craters of the Moon National Monument and Preserve Headquarters, located between the two units of the PNNL (Table 1).

The average monthly maximum temperature reaches its highest point during the month of July, a

month which also marks the beginning of a pronounced dry season; less than 20 percent of the total annual precipitation falls during the period from July through October. Two periods of peak precipitation occur, one in January and the other in May. The length of the period between the last freezing temperature in the spring and the first freeze of fall is about 107 days.

Table 1. Summary of temperature and precipitation for Craters of the Moon National Monument and Preserve, Idaho, from 1958 - 2002 (Western Regional Climate Center 2003).

Month	Temperature				Precipitation		Snow Depth	
	Maximum		Minimum		Mean		Mean	
	°F	°C	°F	°C	inches	mm	inches	mm
January	28.9	-1.7	10.4	-12.0	2.12	54.4	20	513
February	33.8	1.0	14	-10.0	1.58	40.5	26	667
March	41.4	5.2	20.4	-6.4	1.26	32.3	19	487
April	53.4	11.9	28.2	-2.1	1.07	27.4	3	77
May	64.7	18.2	36.9	2.7	1.67	42.8	0	0
June	74.5	23.6	44.7	7.1	1.25	32.1	0	0
July	84.4	29.1	52.1	11.2	0.7	17.9	0	0
August	82.8	28.2	50.3	10.2	0.85	21.8	0	0
September	71.8	22.1	41	5.0	0.86	22.1	0	0
October	59	15.0	31.3	-0.4	0.88	22.6	0	0
November	40.5	4.7	20.6	-6.3	1.36	34.9	2	51
December	29.9	-1.2	11.3	-11.5	1.87	47.9	11	282
Annual	55.4	13.0	30.1	-1.1	15.46	396.4	7	179

Two types of soils support low sagebrush communities in the North Unit of the PNNL. Soils supporting the low sagebrush/Sandberg bluegrass (*Poa secunda*) association are too shallow to support Idaho fescue, and there is little to no soil development (soil order Entisol) (Hironaka et al. 1983). Soils underlying the low sagebrush/Idaho fescue association have not been well studied (Hironaka et al. 1983), but Day and Wright (1985) indicate that they are finer textured and/or deeper than those supporting the low sagebrush/Sandberg bluegrass association.

The distribution of the early low sagebrush/Idaho fescue association in Carey Kipuka (South Unit)

appears to be controlled by the depth to the clay B horizon (Fosberg 1963). Studies of Carey Kipuka by the U.S.D.A. Natural Resource Conservation Service (NRCS) soil-vegetation correlation research team, between 1958 and 1963, classified the soil underlying the early low sagebrush/Idaho fescue association as Gooding loam (Hugie et al. 1964). The soils were formed in basaltic ash and cinders. The surface soil, 0-36 cm (0-14 inches), is brown, slightly acid to neutral loam containing angular basalt pebbles. In the lower 10 cm (4 inches) of this horizon, the ped surfaces are coated with bleached sand and silt grains. The subsoil, at 36-76 cm (14-30 inches), is brown, neutral to mildly alkaline clay with thin continuous clay films. From 76-89 cm (30-35 inches), the soil is pale brown, strongly calcareous clay underlain by basalt (Hugie et al. 1964). Results of the NRCS studies of soil-vegetation relationships in this association are discussed below.

The PNNL was selected to provide representation of the Low Sagebrush/Idaho Fescue Subtheme of the Low Sagebrush Theme. Three associations are included in this subtheme: low sagebrush/bluebunch wheatgrass, low sagebrush/Sandberg bluegrass, and early low sagebrush/Idaho fescue (Hironaka et al. 1983). All three associations occur at the proposed Craters of the Moon National Monument and Preserve NNL, in two different areas of the Monument.

The North Unit includes the low sagebrush communities, where the low sagebrush/Idaho fescue and low sagebrush/Sandberg bluegrass comprise a majority of the vegetation in the unit. These two associations occur over a large area of the unit or in a mosaic pattern with each other. These associations occur on exposed, windswept ridges, where total plant cover is less than 40%. Low sagebrush is the only shrub present in most areas. Common forbs include stemless goldenweed (*Haplopappus acaulis*), Hood's phlox (*Phlox hoodii*), rabbit-foot crazyweed (*Oxytropis lagopus*), mat eriogonum (*Eriogonum caespitosum*), and Indian paintbrush (*Castilleja* spp.). In the low sagebrush/Sandberg bluegrass association Sandberg bluegrass is the dominant grass, with spike-fescue (*Leucopoa kingii*) becoming common at higher elevations. Sandberg bluegrass is replaced by Idaho fescue in the low sagebrush/Idaho fescue association. Total cover is higher in this type, but species richness is similar to the low sagebrush/Sandberg bluegrass association (Day and Wright 1985).

In areas where the soil is deeper, and moisture is retained longer into the growing season, two

mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) associations occur: mountain big sagebrush/bluebunch wheatgrass and mountain big sagebrush/Idaho fescue (Hironaka et al. 1983; Day and Wright 1985).

The South Unit includes the early low sagebrush/Idaho fescue association (Hironaka et al. 1983). This stand has received considerable study beginning in 1958 and continuing to the present (Hugie et al. 1964; Tisdale et al. 1965; Day and Wright 1985). Carey Kipuka was discovered in the fall of 1955 by ecologists from the University of Idaho, who were looking for relict areas on the Snake River Plain to use as reference for the study of climax sagebrush vegetation. Reconnaissance of the area in 1956 was followed by detailed studies of vegetation and soils in 1957 and subsequent years. Altogether, eight permanently marked stands of differing vegetation and soils were sampled. Permanent plots and photographic points were established in the early low sagebrush/Idaho fescue association at this time (Tisdale et al. 1965). These plots were re-measured in 1988 by the Monument staff and biologists from the Cooperative Parks Studies Unit at the University of Idaho. Several of the associations in Carey Kipuka, including the early low sagebrush/Idaho fescue association were studied in cooperation by the University of Idaho ecologists and the Soil Conservation Service soil-vegetation research team (Hugie et al. 1964). Vegetative condition on environmentally similar sites throughout southern Idaho is based largely on a comparison of their vegetation with that of Carey Kipuka (e.g., Hironaka et al. 1983).

The early low sagebrush/Idaho fescue association in Carey Kipuka is a sharply defined and edaphically determined community (map unit 12, Figure 5). The shrub cover consists of a thin stand of early low sagebrush, with about 25 plants/83.6 m² (100 ft²), but a foliar cover of only 1.5% and a mean height of 25.4 cm (10 inches). The sparse herbaceous cover is dominated by Idaho fescue. Thurber's needlegrass (*Stipa thurberiana*), Sandberg bluegrass, and bottlebrush squirreltail (*Sitanion hystrix*) are common associates. The principal forbs are low-growing forms, including mat eriogonum (*Eriogonum caespitosum*), Hood's phlox (*Phlox hoodii*), narrowleaf pussytoes (*Antennaria stenophyllus*), and Beckwith's violet (*Viola beckwithii*). Tall forbs are scarce in this association (Tisdale et al. 1965; Day and Wright 1985).

Hugie et al. (1964) observed that the Gooding loam, which underlies the early low

sagebrush/Idaho fescue association, is the driest found in the kipuka. The well-developed A2 horizon of this soil suggests lateral movement of soil moisture down the slope above the clay B horizon. This is the only soil in the kipuka on which early low sagebrush grows. A variety of grasses grow on this soil but plants are small, widely spaced, and produce little herbage. The abundant growth of Hood's phlox and narrowleaf pussytoes is due to plentiful spring moisture and extensive root systems of the plants. In the early spring the saturated upper 36 cm (14 inches) of this soil is favorable to the growth of Anderson's buttercup (*Ranunculus andersonii*) and Beckwith's violet. Early low sagebrush secures moisture from the clay B horizon and lower horizons to complete its growth later in the season. Root systems of the low forbs in this association, such as narrowleaf pussytoes, Hood's phlox, and mat eriogonum are well suited to soils with clay subsoils. The roots branch profusely under the crown, spread laterally, and penetrate the clay B horizon along vertical cleavage planes. The roots are flattened but unbroken by expansion and contraction of this horizon (Hugie et al. 1964).

Other associations that occur in Carey Kipuka include three-tip sagebrush (*Artemisia tripartita*)/Idaho fescue, basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*)/Idaho, and basin big sagebrush/cheatgrass (Day and Wright 1985).

Because of its size and undisturbed nature, in addition to the soil and vegetation studies that had taken place, Ed Tisdale, Min Hironaka, and Maynard Fosberg, University of Idaho ecologists, made a request to the Department of the Interior that Carey Kipuka be added to the adjacent Craters of the Moon National Monument and Preserve. In 1962 the Carey Kipuka and 7,500 acres of adjacent raw lavas were added to the monument by Presidential order. The purpose was to preserve the outstanding ecological features of the kipuka for scientific study and education (Tisdale et al. 1965).

Land Use and Present Condition

Natural values of the North Unit of the PNNL are currently being protected due to its inclusion within the larger Craters of the Moon National Monument and Preserve. Although some development activity has taken place at lower elevations in the Little Cottonwood Creek area, the ridgeline area constituting the North Unit has not been altered to a significant degree. There are metal-post, barbed-wire

fences running in various directions along the ridge and north slopes and several old mining prospect pits were dug within the proposed area, but their impact is local and minor. Occasionally, cattle trespass into the Monument in this area, but damage to the low sagebrush communities is minor and of no long-term consequence. The major effect of this trespass grazing, if any, would be in the adjacent mountain big sagebrush associations, where available forage is greater and cattle tend to congregate. Little recreational activity appears to take place in the North Unit.

Natural values of the South Unit of the PNNL are currently being protected due to its inclusion within the larger Craters of the Moon National Monument and Preserve and Craters of the Moon Wilderness. Because of the wide expanse of aa lava surrounding Carey Kipuka, no significant amount of livestock grazing, if any, has occurred there. Tisdale et al. (1965) found no evidence of grazing by domestic livestock in the kipuka, but mention an unconfirmed verbal report of grazing by sheep during one winter in the 1920's. One-time use of the vegetation in a dormant state would not be likely to cause any observable changes.

Cheatgrass (*Bromus tectorum*) is abundant in some vegetation types in the kipuka, thought by some to be an indication of past grazing disturbance. Robert Moseley (1989) surveyed numerous isolated kipukas of varying size, in the Craters of the Moon, Wapi, Hells Half Acre, Shohsone, and Cerro Grande lava fields and found cheatgrass in all of them. This suggests that cheatgrass has a tremendous dispersal ability, and has established itself in naturally disturbed gaps in pristine stands, especially those on loess substrates. Tisdale et al. (1965) observed considerable mortality of Idaho fescue plants in Carey Kipuka between 1961 and 1963. Much of the space released by this die-off was invaded by cheatgrass.

A faint trail, marked by cairns, leads to Carey Kipuka from Laidlaw Park. Recreational activity in the kipuka appears to be minimal; however, Shelly Hall, Resource Specialist with Craters of the Moon National Monument and Preserve, observed horse tracks in the kipuka in 1988. The rough nature of the surrounding aa lava and lack of significant attractions, including hunting opportunity, will preclude significant recreational use of the area.

Anticipated Damage to the Area

Natural values of the PNNL are currently being protected due to its inclusion within the larger Craters of the Moon National Monument and Preserve. In addition, the South Unit is within the Craters of the Moon Wilderness. No roads exist within the PNNL, and no roads are currently being planned. Recreational use of the proposed area is expected to be minimal.

Effects of Publicity

The PNNL is not expected to be sensitive to increased publicity. The only effect foreseen of increased publicity is positive, that is, more of the public will learn of the additional nationally significant values of the Monument. Any increase in visitor use to the PNNL is not expected to be great enough to impact the ecology of the area.

Ownership

All land within the PNNL is Federally owned. The U.S. Department of the Interior, Craters of the Moon National Monument and Preserve, administers both surface and mineral rights of the South Unit and most of the North Unit. Craters of the Moon National Monument and Preserve may be contacted at the following address and telephone number: Craters of the Moon National Monument and Preserve, Arco, ID 83213, (208) 527-3257. The ^{more than just the NW portion} northwest portion of the North Unit is administered by U.S. Department of the Interior, Bureau of Land Management, Upper Snake River District (contact information: Idaho Falls Field Office, 1405 Hollipark Drive, Idaho Falls, ID 83401-2100, (208) 524-7500).

This changes after Oct 1, 2004

NPS

DO-130809

ANALYSIS

Significance

The occurrences of low sagebrush associations within Craters of the Moon National Monument and Preserve are outstanding examples of the Low Sagebrush/Idaho fescue Subtheme of the Low Sagebrush Theme, as defined in Phase I of the 1989 study (The Nature Conservancy et al. 1989). The stands are among the best known examples of this subtheme in the Columbia Plateau Natural Region, as

evaluated in Phase II of the 1989 study (Crawford et al. 1989). Stands of low sagebrush within the PNNL represent higher elevation, mountainous occurrences of the subtheme. To capture the full diversity of the subtheme, lower elevation, plateau occurrences of low sagebrush/Idaho fescue should be evaluated for designation as an PNNL.

The stands of early low sagebrush within the PNNL are outstanding for their value to science and education due to the long history studies within the stands. To capture the full diversity of the early low sagebrush/Idaho fescue subtheme additional, larger stands should be considered for PNNL designation.

Recommendation

In my opinion, the site is nationally significant. I recommend that it be designated as a National Natural Landmark.

Management Guidelines

Natural values of the PNNL are currently being protected due to its inclusion within the larger Craters of the Moon National Monument and Preserve. In addition, the South Unit is within the Craters of the Moon Wilderness. Current management of the Monument appears compatible with the long-term viability of the ecological features of the PNNL.

Cattle occasionally wander into the North Unit, but do not remain there long due to lack of water. Although no increase in cattle grazing is anticipated, over and above the incidental use that takes place there now, it should be periodically monitored.

The PNNL is well removed from areas of concentrated recreational use on the Monument and can easily be managed to protect natural values of the PNNL.

Prescribed burning of mountain big sagebrush stands adjacent to the North Unit will probably have little impact on the low sagebrush communities on the ridge; fuel loads are very light in low sagebrush communities and will not carry a fire far into the stands.

General Background

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Information contained in this report is based on literature cited and interviews with Craters of the Moon National Monument and Preserve personnel conducted by R. K. Moseley in 1989 and C. J. Murphy in 2001. Ed Tisdale, Emeritus Professor of Range Ecology, University of Idaho, and member of the Idaho Natural Areas Committee, provided considerable data and insight into the ecology of Carey Kipuka. R. K. Moseley inventoried the PNNL in October 1989. C. J. Murphy inventoried the PNNL in June 2001.

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APPENDIX A

List of Figures.

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- Figure 4. Low sagebrush/Idaho fescue (*Artemisia arbuscula/Festuca idahoensis*) plant association in the north unit of Craters of the Moon National Monument and Preserve PNNL.
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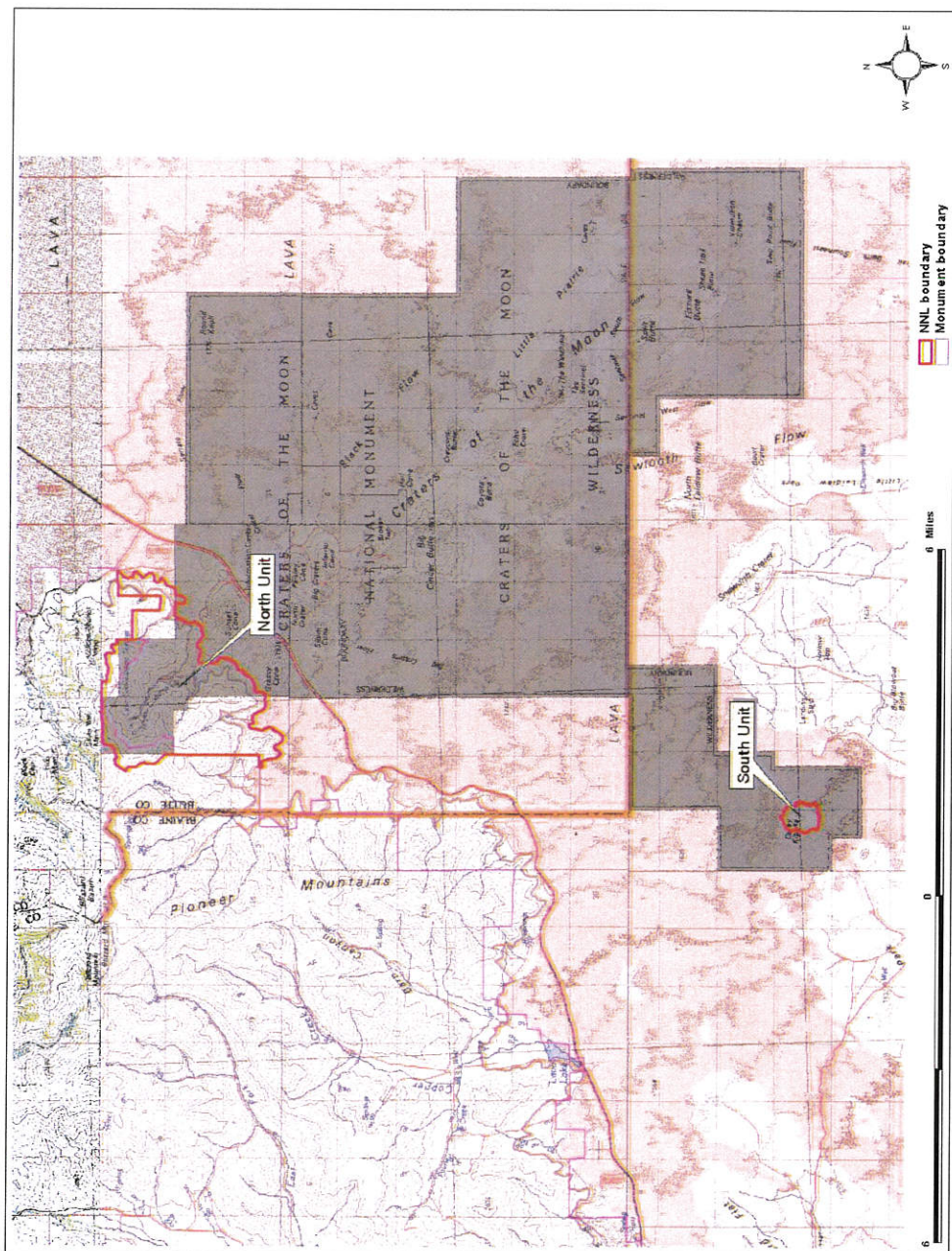


Figure 1. The location of Craters of the Moon proposed NNL (South and North units) is shown in relation to Craters of the Moon National Monument and Preserve, Blaine and Butte counties, Idaho (portion of Craters of the Moon (1993) and Arco (2000) Surface Management Status Map).

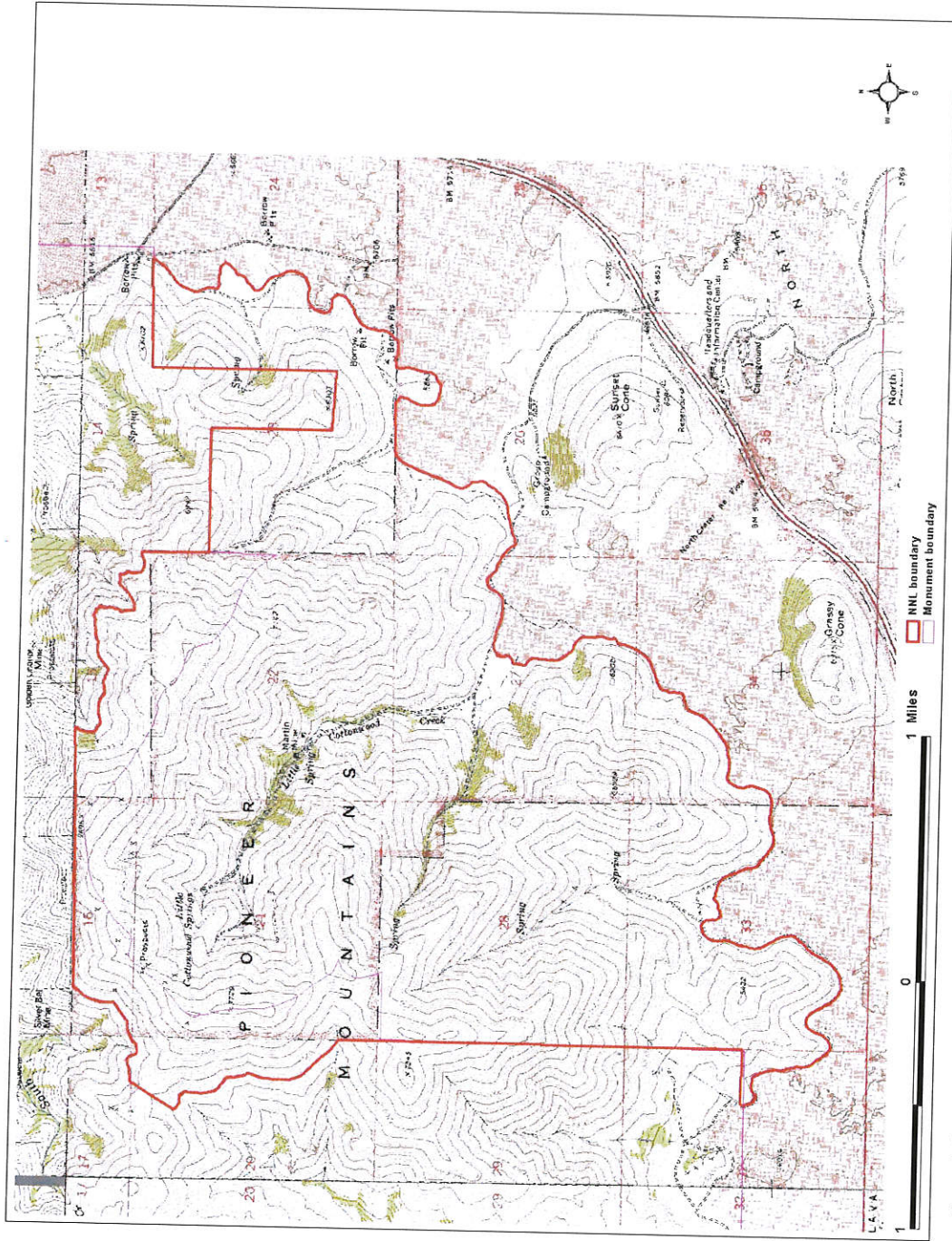


Figure 2. Location of the North Unit of the proposed Craters of the Moon National Monument NNL on ridges surrounding Little Cottonwood Canyon (portion of Inferno Cone 7.5' Quadrangle).

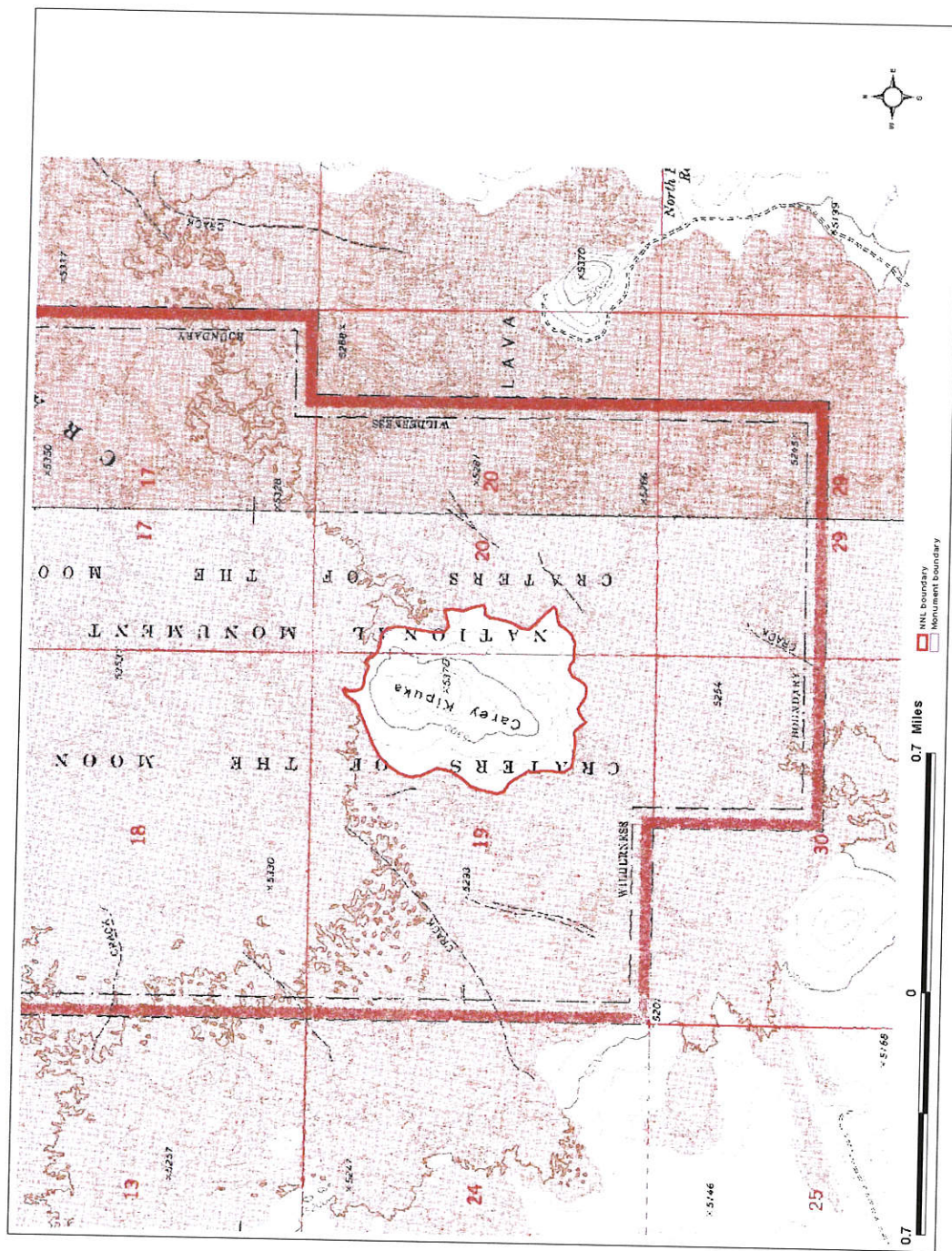


Figure 3. Location of Carey Kipuka, the South Unit of the proposed Craters of the Moon National Monument and Preserve NNL (portion of Little Park 7.5' Quadrangle).



Figure 4. Low sagebrush/Idaho fescue (*Artemisia arbuscula/Festuca idahoensis*) plant association in the north unit of Craters of the Moon National Monument and Preserve PNNL. The association occurs on broad, north-facing ridgecrests within the natural area. Photograph by R. K. Moseley, October 1989.

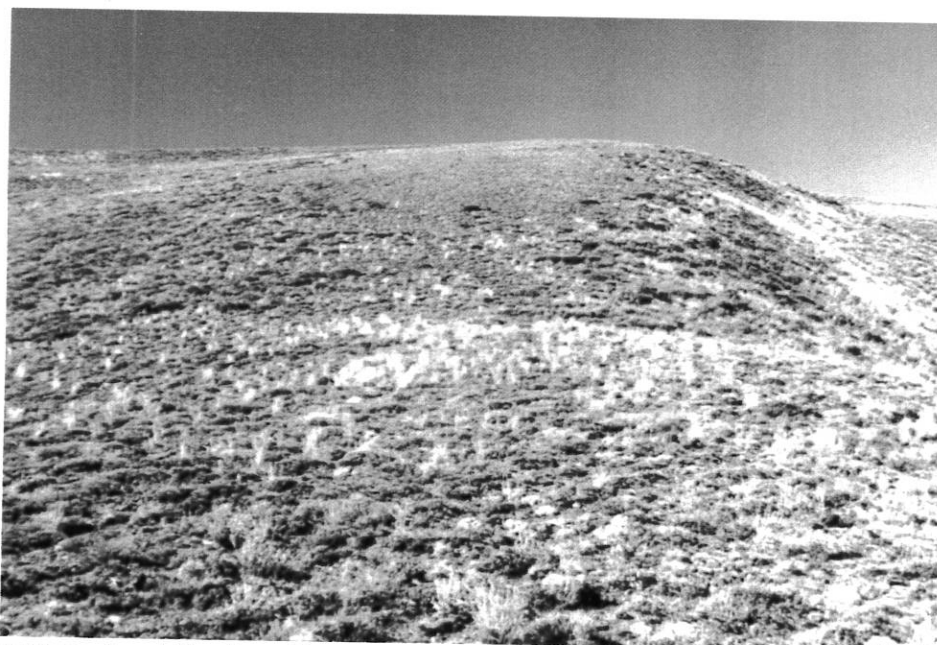


Figure 5. Low sagebrush/Sandberg bluegrass (*Artemisia arbuscula/Poa secunda*) plant association (upper center) on a south-facing slope within the north unit of Craters of the Moon National Monument and Preserve PNNL. Photograph by R. K. Moseley, October 1989.



Figure 6. View south within the north unit of Craters of the Moon National Monument PNNL. The view is looking down Little Cottonwood Creek, out across the Great Rift. Photograph by R. K. Moseley, October 1989.



Figure 7. The early low sagebrush/Idaho fescue (*Artemisia longiloba*/*Festuca idahoensis*) plant association within Carey Kipuka (Craters of the Moon National Monument and Preserve PNNL south unit). The flags mark the location of permanent plots established by Tisdale et al. (1965) in 1957. Photograph by R. K. Moseley, October 1989.



Figure 8. Vegetation distribution patterns on the north unit, Craters of the Moon National Monument and Preserve PNNL. Mountain big sagebrush (*Artemisia tridentata vaseyana*) plant associations occur on a leeward slope above and below a snow drift zone that is dominated by Wyeth's buckwheat (*Eriogonum heracleoides*) and lupine (*Lupinus argenteus*). C. J. Murphy photography, June 2001.



Figure 9. The basin big sagebrush/Idaho fescue (*Artemisia tridentata tridentata*/*Festuca idahoensis*) within Carey Kipuka, the southern unit of Craters of the Moon National Monument and Preserve PNNL. C. J. Murphy photography, June 2001.



Figure 10. The early low sagebrush/Idaho fescue (*Artemisia longiloba*/*Festuca idahoensis*) plant association within Cary Kipuka, the southern unit of Craters of the Moon National Monument and Preserve PNNL. C. J. Murphy photograph, June 2001.

APPENDIX B

Common and scientific names of the vascular plant, mammal, reptile and bird species of known or probable occurrence within the recommended boundaries.

Vascular plant species observed in the proposed Craters of the Moon National Monument and Preserve NNL.

Trees	
<i>Pinus flexilis</i>	limber pine
Shrubs	
<i>Amelanchier utahensis</i>	Utah serviceberry
<i>Artemisia arbuscula</i>	little sagebrush
<i>Artemisia longiloba</i>	early low sagebrush
<i>Artemisia tridentata</i> ssp. <i>tridentata</i>	Wyoming big sagebrush
<i>Artemisia tridentata</i> ssp. <i>vaseyana</i>	mountain big sagebrush
<i>Artemisia tridentata</i> var. <i>wyomingensis</i>	Wyoming big sagebrush
<i>Artemisia tripartita</i>	three-tip sagebrush
<i>Chrysothamnus nauseosus</i>	green rabbit-brush
<i>Chrysothamnus viscidiflorus</i>	green rabbitbrush
<i>Philadelphus lewisii</i>	Lewis' mock orange
<i>Prunus virginiana</i>	chokecherry
<i>Purshia tridentata</i>	antelope bitterbrush
<i>Ribes cereum</i>	wax currant
<i>Rosa woodsii</i>	Woods' rose
<i>Symphoricarpos oreophilus</i>	mountain snowberry
Herbs	
<i>Achillea millefolium</i>	common yarrow
<i>Agoseris glauca</i>	pale agoseris
<i>Allium</i> spp	onion
<i>Allium acuminatum</i>	tapertip onion
<i>Antennaria dimorpha</i>	low pussytoes
<i>Antennaria microphylla</i>	littleleaf pussytoes
<i>Antennaria stenophylla</i>	narrowleaf pussytoes
<i>Arabis</i> spp.	rockcress
<i>Arabis holboellii</i>	Holboell's rockcress
<i>Arenaria aculeata</i>	prickly sandwort
<i>Arenaria congesta</i>	ballhead sandwort
<i>Arnica sororia</i>	twin arnica
<i>Artemisia ludoviciana</i>	white sagebrush
<i>Aster scopulorum</i>	lava aster
<i>Astragalus</i>	milkvetch
<i>Astragalus convallarius</i>	lesser rushy milkvetch
<i>Astragalus filipes</i>	basalt milkvetch
<i>Astragalus purshii</i>	Pursh's milkvetch
<i>Astragalus whitneyi</i>	Whitney's milkvetch
<i>Balsamorhiza hookeri</i>	Hooker's balsamroot
<i>Balsamorhiza sagittata</i>	arrowleaf balsamroot
<i>Calochortus</i> spp.	mariposa lily
<i>Castilleja chromosa</i>	desert paintbrush
<i>Castilleja miniata</i>	giant red Indian paintbrush
<i>Castilleja pallescens</i>	pale Indian paintbrush
<i>Chaenactis douglasii</i>	Douglas' dustymaiden
<i>Chamaebatiaria millefolium</i>	fernbush
<i>Cirsium canovirens</i>	graygreen thistle
<i>Cirsium utahense</i>	Utah thistle
<i>Collinsia parviflora</i>	maiden blue eyed Mary

Collomia linearis
Cordylanthus ramosus
Crepis acuminata
Crepis occidentalis
Cryptantha spp.
Cymopterus terebinthinus var. *foeniculaceus*
Delphinium spp.
Descurainia richardsonii
Eriastrum sparsiflorum
Erigeron bloomeri
Erigeron compositus
Erigeron pumilus
Eriogonum caespitosum
Eriogonum compositum
Eriogonum heracleoides
Eriogonum mancum
Eriogonum microthecum
Eriogonum ovalifolium
Eriogonum umbellatum
Eriophyllum lanatum
Fritillaria atropurpurea
Fritillaria pudica
Galium bifolium
Gayophytum spp.
Gayophytum decipiens
Gilia aggregata
Hackelia micrantha
Haplopappus acaulis
Heuchera spp.
Hieracium albertinum
Hydrophyllum capitatum
Lactuca serriola
Lappula redowskii
Leptodactylon pungens
Lewisia rediviva
Linanthus septentrionalis
Lithospermum ruderale
Lomatium dissectum
Lomatium triternatum
Lupinus argenteus
Lupinus caudatus
Machaeranthera canescens
Mentzelia albicaulis
Mertensia oblongifolia
Microseris nutans
Microseris troximoides
Microseris gracilis
Mimulus nanus
Navarretia breweri
Osmorhiza occidentalis
Oxytropis lagopus
Penstemon humilis
Phacelia hastata
Phacelia linearis

tiny trumpet
 bushy bird's beak
 taper-tip hawksbeard
 largeflower hawksbeard
 cryptantha
 turpentine cymopterus
 larkspur
 mountain tansymustard
 Great Basin woollystar
 scabland fleabane
 cut-leaf fleabane
 shaggy fleabane
 mat eriogonum
 arrowleaf buckwheat
 Wyeth eriogonum
 imperfect buckwheat
 slender buckwheat
 cushion buckwheat
 sulphur-flower buckwheat
 Oregon sunshine
 checker-lily
 yellow fritillary
 twinleaf bedstraw
 groundsmoke
 deceptive groundsmoke
 scarlet gilia
 Jessica sticktight
 stemless goldenweed
 alumroot
 western hawkweed
 ballhead waterleaf
 prickly lettuce
 western stickseed
 granite prickly phlox
 bitter root
 northern linanthus
 western stoneseed
 fernleaf biscuitroot
 desert-parsley
 silver lupine
 tailcup lupine
 hoary tansyaster
 white-stemmed mentzelia
 oblongleaf bluebells
 nodding microceris
 false agoseris
 microsteris
 dwarf purple monkeyflower
 Brewer's navarretia
 western sweetroot
 haresfoot locoweed
 low beardtongue
 silverleaf phacelia
 threadleaf phacelia

Phlox hoodii
Phlox longifolia
Polygonum
Polygonum douglasii
Potentilla glandulosa
Ranunculus andersonii
Sedum stenopetalum
Senecio canus
Senecio integerrimus
Senecio serra
Sisymbrium altissimum
Stephanomeria tenuifolia
Tetradymia canescens
Tragopogon dubius
Valeriana acutiloba var. *pubicarpa*
Viola beckwithii
Viola purpurea
Wyethia amplexicaulis
Zigadenus venenosus

Hood's phlox
 long-leaf phlox
 knotweed
 Douglas' knotweed
 sticky cinquefoil
 Anderson's buttercup
 stonecrop
 woolly groundsel
 butterweed
 tall ragwort
 tall tumbledustard
 bush wirelettuce
 horsebrush
 yellow salsify
 hairyfruit valerian
 Beckwith's violet
 goosefoot violet
 mule-ears
 deadly zigadenus

Grasses, sedges, and rushes

Agropyron smithii
Agropyron spicatum
Agropyron trachycaulum
Bromus carinatus
Bromus japonicus
Bromus tectorum
Carex douglasii
Carex filifolia
Carex hoodii
Carex siccata
Carex vallicola
Elymus cinereus
Festuca idahoensis
Koeleria cristata
Koeleria nitida
Leucopoa kingii
Melica bulbosa
Melica fugax
Oryzopsis hymenoides
Poa cusickii
Poa sandbergii
Poa secunda
Poa wheeleri
Sitanion hystrix
Stipa columbiana var. *nelsonii*
Stipa comata
Stipa occidentalis
Stipa thurberiana

bluestem wheatgrass
 bluebunch wheatgrass
 slender wheatgrass
 California brome
 Japanese brome
 cheatgrass
 Douglas' sedge
 threadleaf sedge
 Hood's sedge
 silvertop sedge
 valley sedge
 giant wildrye
 Idaho fescue
 prairie junegrass
 junegrass
 spike fescue
 oniongrass
 little oniongrass
 Indian ricegrass
 Cusick's bluegrass
 Sandberg bluegrass
 Sandberg bluegrass
 Wheeler's bluegrass
 squirreltail bottlebrush
 Columbia needlegrass
 needle-and-thread
 western needlegrass
 Thurber's needlegrass

Mammals, reptiles, and birds of probable occurrence within the proposed Craters of the Moon National Monument NNL.

MAMMALS

<i>Sorex vagrans</i>	vagrant shrew
<i>Sorex monticolus</i>	dusky shrew
<i>Sorex merriamii</i>	Merriam's shrew
<i>Myotis lucifugus</i>	little brown bat
<i>Myotis evotis</i>	long-eared bat
<i>Myotis californicus</i>	California myotis
<i>Lasiurus cinereus</i>	hoary bat
<i>Plecotus townsendii</i>	Townsend's big-eared bat
<i>Ochontona princeps</i>	pika
<i>Brachylagus idahoensis</i>	pygmy rabbit
<i>Sylvilagus nuttallii</i>	Nuttall's cottontail
<i>Lepus americana</i>	snowshoe hare
<i>Lepus townsendii</i>	white-tailed jackrabbit
<i>Lepus californica</i>	black-tailed jackrabbit
<i>Marmota flaviventris</i>	yellow-bellied marmot
<i>Spermophilus columbianus</i>	Columbian ground squirrel
<i>Spermophilus lateralis</i>	golden-mantled g. squirrel
<i>Thomomys talpoides</i>	northern pocket gopher
<i>Perognathus parvus</i>	Great Basin pocket mouse
<i>Reithrodontomys megalotis</i>	western harvest mouse
<i>Peromyscus maniculatus</i>	deer mouse
<i>Neotoma cinerea</i>	bushy-tailed woodrat
<i>Microtus montanus</i>	montane vole
<i>Microtus longicaudus</i>	long-tailed vole
<i>Zapus princeps</i>	western jumping mouse
<i>Canis latrans</i>	coyote
<i>Vulpes vulpes</i>	red fox
<i>Ursus americanus</i>	black bear
<i>Procyon lotor</i>	raccoon
<i>Mustela erminea</i>	short-tailed weasel
<i>Mustela frenata</i>	long-tailed weasel
<i>Taxidea taxus</i>	badger
<i>Mephitis mephitis</i>	striped skunk
<i>Felis concolor</i>	mountain lion
<i>Felis rufus</i>	bobcat
<i>Cervus elaphus</i>	elk
<i>Odocoileus hemionus</i>	mule deer
<i>Antilocarpa americanus</i>	pronghorn

AMPHIBIANS

<i>Bufo boreas</i>	western toad
<i>Pseudacris triseriata</i>	boreal chorus frog

REPTILES

<i>Phrynosoma douglasii</i>	short horned lizard
<i>Sceloporus graciosus</i>	sagebrush lizard
<i>Eumeces skiltonianus</i>	western skink
<i>Charina bottae</i>	rubber boa
<i>Coluber constrictor</i>	racer

Pituophis melanoleucus
Crotalus viridis

gopher snake
western rattlesnake

BIRDS

Cathartes aura
Circus cyaneus
Buteo swainsoni
Buteo jamaicensis
Buteo regalis
Buteo lagopus
Aquila chrysaetos
Falco sparverius
Falco columbarius
Falco mexicanus
Alectoris chukar
Dendragapus obscurus
Centrocercus urophasianus
Columba livia
Zenaida macroura
Bubo virginianus
Asio otus
Asio flammeus
Aegolius acadicus
Chordeiles minor
Phalaenoptilus nuttallii
Aeronautes saxatalis
Archilchus alexandri
Stellula calliope
Selasphorus rufus
Colaptes auratus
Empidonax oberholseri
Sayornis saya
Myiarchus cinerascens
Tyrannus verticalis
Eremophila alpestris
Tachycineta bicolor
Pica pica
Corvus corax
Salpinctes obsoletus
Sialia currucoides
Myadestes townsendi
Oreoscoptes montanus
Lanius excubitor
Lanius ludovicianus
Vermivora celata
Passerina amoena
Pipilo chlorurus
Pipilo erythrophthalmus
Spizella passerina
Spizella breweri
Poocetes gramineus
Chondestes grammacus
Amphispiza bilineata
Amphispiza belli

turkey vulture
northern harrier
Swainson's hawk
red-tailed hawk
ferruginous hawk
rough-legged hawk
golden eagle
American kestrel
merlin
prairie falcon
chukar
blue grouse
sage grouse
rock dove
mourning dove
great horned owl
long-eared owl
short-eared owl
northern saw-whet owl
common nighthawk
common poorwill
white-throated swift
black-chinned hummingbird
calliope hummingbird
rufous hummingbird
northern flicker
dusky flycatcher
say's phoebe
ash-throated flycatcher
western kingbird
horned lark
tree swallows
black-billed magpie
common raven
rock wren
mountain bluebird
Townsend's solitaire
sage thrasher
northern shrike
loggerhead shrike
orange-crowned warbler
lazuli bunting
green-tailed towhee
rufous-sided towhee
chipping sparrow
Brewer's sparrow
vesper sparrow
lark sparrow
black-throated sparrow
sage sparrow

Passerculus sandwichensis
Zonotrichia leucophrys
Plectrophenax nivalis
Sturnella negelecta
Euphagus cyanocephalus
Molothrus ater

savannah sparrow
white-crowned sparrow
snow bunting
western meadowlark
Brewer's blackbird
brown-headed cowbird

Craters of the Moon National Monument and Preserve
National Natural Landmark Brief

Location: 31 km (19 miles) east of Carey, Blaine and Butte Counties, Idaho.

Natural Region: Columbia Plateau

Size: 1626.5 ha (4019.1 acres)

Owner: Federal; Administered by the U.S. Department of the Interior, National Park Service, Craters of the Moon National Monument and Preserve and U.S. Department of the Interior, Bureau of Land Management, Upper Snake River District.

Description: The site occurs in Craters of the Moon National Monument and Preserve on the northern edge of the Snake River Plain, a large, relatively flat volcanic surface that bisects southern Idaho. The Monument encompasses the most diverse and geologically recent part of the Plain, and part of the adjacent foothills of the Pioneer Mountains. The PNNL is composed of two units. The North Unit encompasses low sagebrush (*Artemisia arbuscula*) associations on a ridge system in the Pioneer foothills at the north end of the Monument. The South Unit encompasses Carey Kipuka at the southwest corner of the Monument.

The PNNL represents the Low Sagebrush/Idaho Fescue Subtheme of the Low Sagebrush Theme. Three associations are included in this subtheme, low sagebrush/Idaho fescue (*Festuca idahoensis*), low sagebrush/Sandberg bluegrass (*Poa sandbergii*), and early low sagebrush (*Artemisia longiloba*)/Idaho fescue.

Excellent examples of the low sagebrush associations occur in the North Unit, largely confined to wind-swept ridges and north-facing slopes around the head of Little Cottonwood Creek canyon. In areas with deeper soil, mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) associations occur.

An excellent example of the early low sagebrush association occurs in Carey Kipuka (South Unit). Extensive examples of basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) and three-tip sagebrush (*Artemisia tripartita*) associations also occur in the unit. Carey Kipuka has had a 30 year history of ecological research. It has been used as an ecological reference area for soil - vegetation correlation by the University of Idaho and the Natural Resource Conservation Service, and has had permanent monitoring plots established since 1957.

Significance: The two low sagebrush and one early low sagebrush communities occurring in Craters of the Moon National Monument and Preserve are outstanding examples of the Low Sagebrush/Idaho fescue Subtheme of the Low Sagebrush Theme. The PNNL is considered the best known example of this subtheme in the Columbia Plateau Natural Region.

Land use: The ecological condition of the site is excellent, due largely to its inclusion in the Craters of the Moon National Monument and Preserve and to physical barriers that have prevented disturbance. The South Unit is in the Craters of the Moon Wilderness.

Special conditions: Natural values of the PNNL are currently being protected due to its inclusion within the larger Craters of the Moon National Monument and Preserve. The South Unit is also in the Craters of the Moon Wilderness.

Proposed by: Rexford C. Crawford, Washington Natural Heritage Program, Jimmy S. Kagan, Oregon Natural Heritage Data Base, and Robert K. Moseley, Idaho Natural Heritage Program; 1989; Phase I and II Reports, 1989 National Natural Landmark Project, Columbia Plateau Natural Region Ecological Themes, National Park Service.

Evaluated by: Steven K. Rust, Ecologist, Idaho Conservation Data Center, Department of Fish and Game,
Boise, ID, June 2002.

Designated:

Owner agreement: