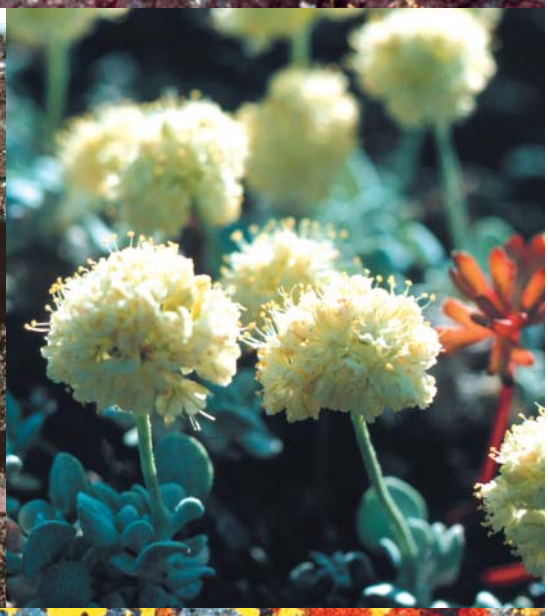
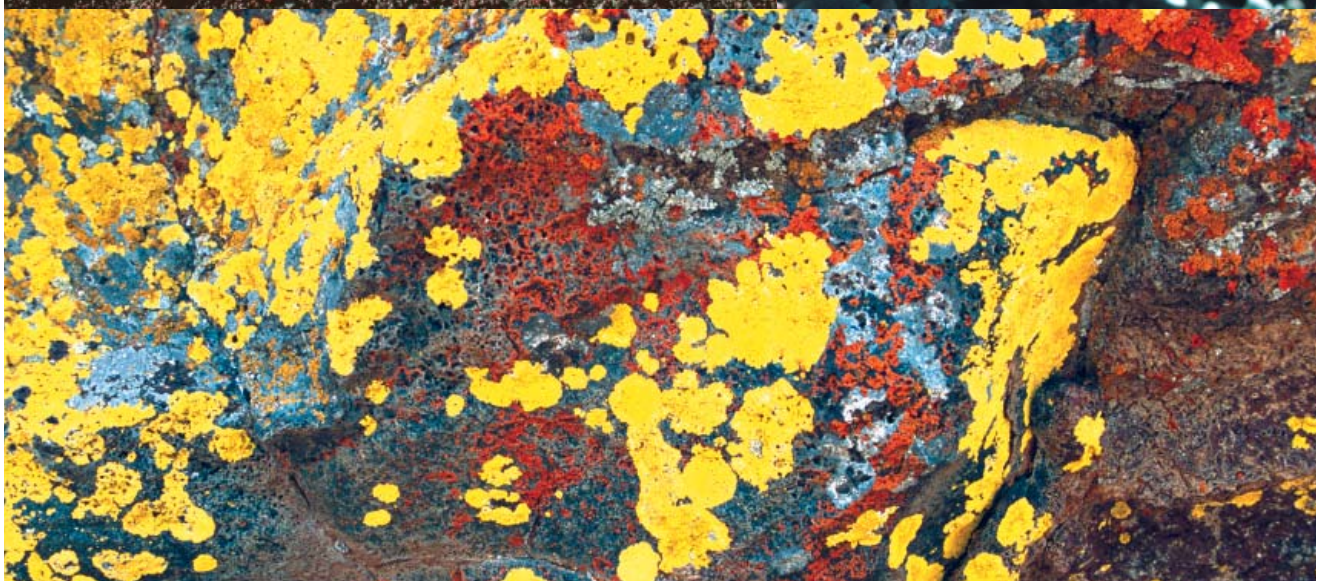
Chapter 3
Affected Environment





Previous page, clockwise, from top left
Hornito
Dwarf buckwheat
Lava lichen
Lava bombs

CHAPTER 3 AFFECTED ENVIRONMENT

The purpose of this chapter is to describe the physical, biological, cultural, and social environments of the Craters of the Moon National Monument and Preserve (the Monument), including human uses, that could be affected from implementing any of the alternatives described in Chapter 2. The topics discussed in this chapter are those identified as important issues by the public and the agencies during scoping. The discussion generally follows the order of the topics addressed in Chapter 2 under "Management Guidance Common to All Alternatives." The scientific names for species mentioned in the text are listed in Appendix D.

NATURAL RESOURCES

GEOLOGICAL RESOURCES

The purpose and significance of the Monument tie directly to its unique geology. Volcanism has generated an array of features and habitats that make the Monument a recognized outdoor laboratory. As a result, the Monument draws scientists and visitors from around the world to study and experience the diverse volcanic terrain.

Geologic Setting

The Monument is in the Snake River Basin-High Desert (Omernik 1986) and is primarily comprised of three geologically young (Late Pleistocene-Holocene) lava fields that lie along the Great Rift (see Figure 11 for regional setting and location). The Great Rift volcanic rift zone is a belt of open cracks, eruptive fissures, shield volcanoes, and cinder cones, which varies in width between approximately 1 and 5 miles. It begins north of the Monument, approximately 6 miles from the topographic edge of the Snake River Plain, in the vent area of the Lava Creek flows located in the southern Pioneer Mountains (Kuntz et al. 1992). The Great Rift extends southeasterly from the Lava Creek vents for more than 50 miles to somewhere beneath the Wapi Lava Field (Kuntz et al. 1982).

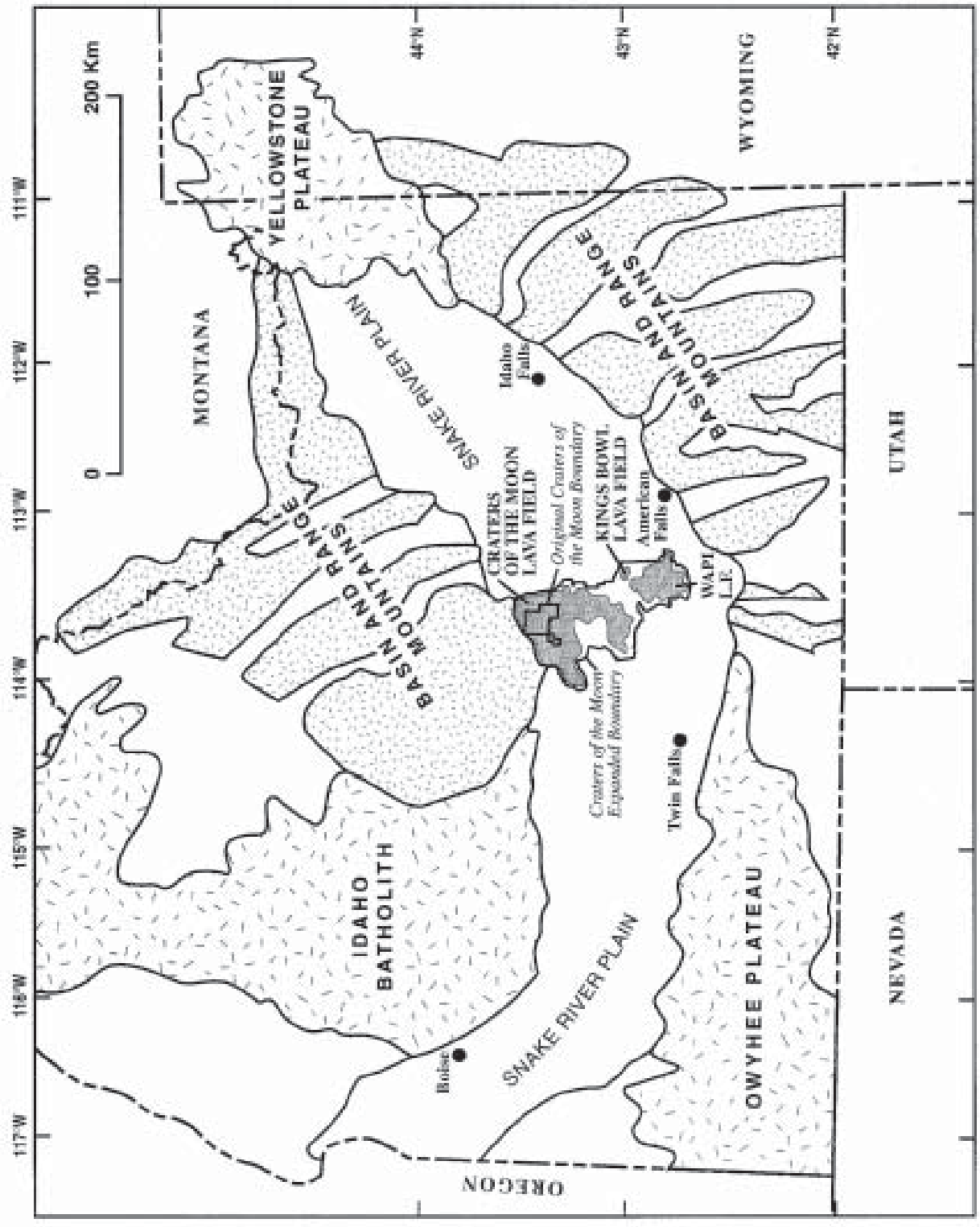
The Craters of the Moon Lava Field is the northernmost and largest of the three young lava fields. Kings Bowl Lava Field is the smallest and lies between Craters of the Moon Lava Field and the Wapi Lava Field. The rest of the Monument is composed of Pleistocene age pahoehoe and a'a flows, near-vent tephra deposits, cinder cones, lava cones, and shield volcanoes (Kuntz et al. 1988). These older areas are mantled with loess deposits (windblown silt) and in some places by windblown sand. During the Holocene (last 10,000 years), the most volcanic activity of any of the Eastern Snake River Plain (ESRP) basaltic rift systems was exhibited by these three lava fields associated with the Great Rift (Hughes et al. 1999).

The Craters of the Moon Lava Field covers 618 square miles and is the largest dominantly Holocene basaltic lava field in the lower 48 states (Kuntz et al. 1992). It contains a tremendous diversity of volcanic features, with nearly every type of feature associated with basaltic systems (Hughes et al. 1999). Contained within the Craters of the Moon Lava Field are at least 60 lava flows, 25 tephra cones, and eight eruptive fissure systems aligned along the northern part of the Great Rift (Kuntz et al. 1992).

Kings Bowl Lava Field formed approximately 2,200 years ago during a single burst of eruptive activity that may have lasted as little as six hours (Kuntz et al. 1992). Kings Bowl has a central eruptive fissure approximately 4 miles long, flanked by two sets of non-eruptive fissures. The dominant feature is a bowl, 280 feet long, 100 feet wide, and 100 feet deep, produced when lava came into contact with groundwater, causing a steam or phreatic explosion.

Adjacent to the bowl is an outstanding example of a lava lake with well-developed levees. The crust of the lake was broken by many of the blocks ejected by the phreatic explosion. The interior of this lake was still molten and oozed up through the holes punched in its crust, resulting in a large number of squeeze-up mounds of gas-charged lava (Hughes et al. 1999). Fissure caves, such as Crystal Ice Cave

Figure 11
Regional Geological Settings

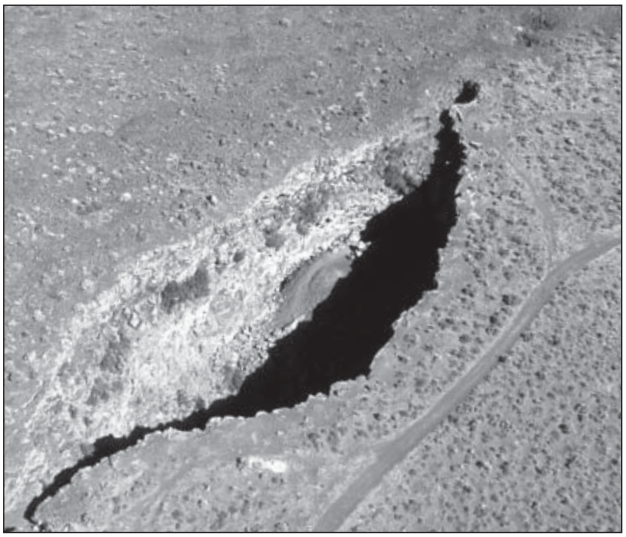


Note: L.F. = Lava Field

and Creons Cave, lie along the Great Rift at Kings Bowl. At South Grotto, the rift may be passable to a depth of 650 feet below the surface (Earl 2001). Feeder dikes and spatter cones can be seen along the Great Rift at Kings Bowl.

The Wapi Lava Field, approximately 2,200 years old (Hughes et al. 1999), is a classic shield volcano with a flattened dome shape. Kuntz et al. (1992) believe that the Wapi Lava Field began as a fissure eruption, but developed a sustained eruption from a central vent complex, which produced the low shield volcano seen today. Rising approximately 60 feet above the south side of the largest vent is Pillar Butte. Greeley (1971) reported that the only known dribblet spires in the continental United States occur on the flows associated with Pillar Butte. Now, however, dribblet spires are known to also occur in Diamond Craters in Oregon.

Candy Kiss



King's Bowl

Potential for Future Eruptions

The Craters of the Moon Lava Field formed during eight eruptive periods with a recurrence interval averaging 2,000 years, and it has been more than 2,000 years since the last eruption. The constancy of the most recent eruptive periods suggests that slightly more than one cubic mile of lava will be erupted during the next eruption period.

In the past, eruptions in the Craters of the Moon Lava Field have generally shifted to the segment of the Great Rift with the longest repose interval. The next eruptive period should begin along the central portion of the Great Rift in the Craters of the Moon Lava Field, but may include the northern part of the Monument (Kuntz et al. 1986). Initial flows, based on past performance, will probably be relatively non-explosive and produce large-volume pahoehoe flows. Eruptions from potential vents on the northern part of the Great Rift may be comparatively explosive and may produce significant amounts of tephra, destroy cinder cones and build new ones (Kuntz et al. 1986).

Geologic Features

The lava is described by its physical appearance, which is largely determined by its composition, temperature, fluid and crystal content, and the

Pahoehoe

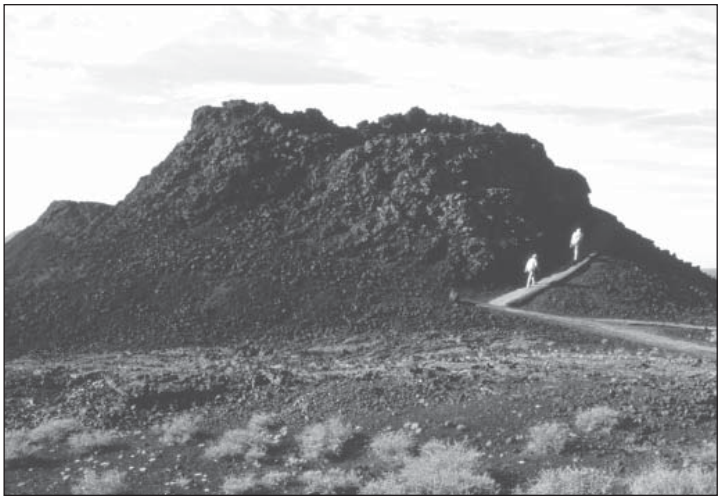
influence exerted on it by the surface and slope it flowed down. Block lava has a surface of angular blocks and forms from very dense lava. A'a has a rough, jagged, or clinkery surface. Pahoehoe has a smooth, ropy, or billowy surface.

There are several types of pahoehoe. Shelly pahoehoe forms from highly gas-charged lava, often near vents or tube skylights, and contains small open tubes, blisters, and thin crusts. Some shelly pahoehoe crusts are so thin and fragile that they are easily broken by foot traffic; much of the shelly pahoehoe that surrounds Pillar Butte is like this. Spiny pahoehoe forms from very thick and pasty lava and contains elongated gas bubbles on the surface that form spines. Spiny pahoehoe is the dominant type of pahoehoe found in the Monument. Slabby pahoehoe is made up of jumbled up plates or slabs of broken pahoehoe crust. Many of the pahoehoe crusts are glassy and may exhibit various shades of blue or green prized by collectors. These glassy crusts are also prone to damage from foot traffic.

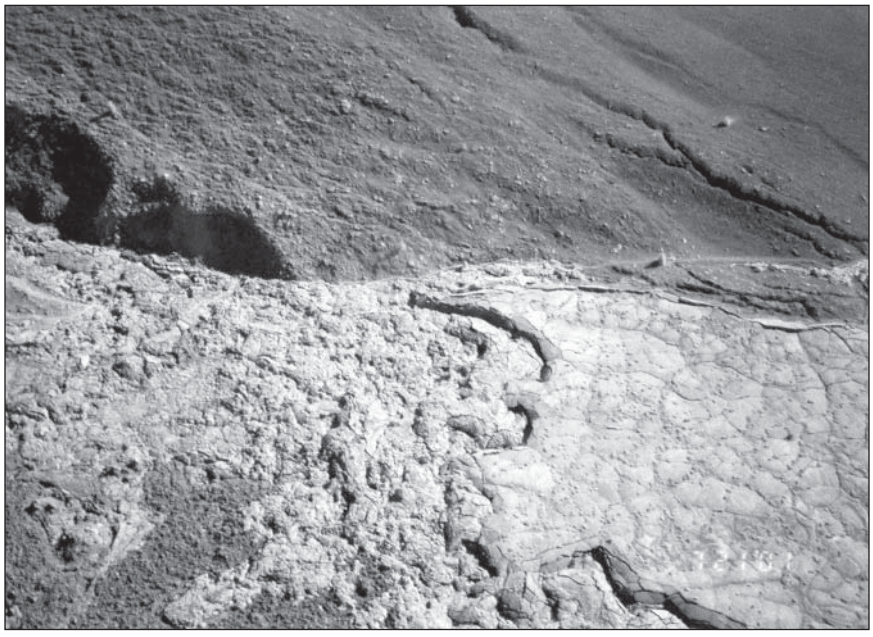
Lava tubes are hollow spaces beneath the surface of solidified lava flows, formed by the withdrawal of molten lava after the formation of the surface crust. Within lava tubes, various formations such as lava stalactites occur that are vulnerable to damage or theft.

Most of the lava flows in the Monument are pahoehoe and were fed through tubes and tube systems. Some lava flows produce tumuli (small mounds) or pressure ridges (elongate ridges) on their crusts. There are also pressure plateaus that were produced by the sill-like injection of new lava beneath the crust of an earlier sheet flow that had not completely solidified. In some places, squeeze-ups formed when pressure was sufficient to force molten lava up through tension fractures in the top of pressure ridges or cracks in the solidified crust of lava ponds. Because of their small size and unusual shapes, many of the squeeze-ups associated with the Kings Bowl Lava Field are vulnerable to theft.

When lava comes to the surface, highly charged with gas, and is ejected from one or a few vents, it can spray high into the air forming a fire fountain(s). The highly gas-charged molten rock cools and solidifies during flight and rains down to form cinder cones. Loose cinders are particularly vulnerable to compaction and wind and water erosion. Cinders displaying a play of colors, caused by a thin layer of glass, also make a tempting target for souvenir gatherers.



Spatter Cone



Pressure Plateau

Other lava features include spatter cones that formed when fluid globs (spatter) were ejected short distances (generally less than 200 feet) from some of the vents and accumulated right around the vent, forming short steep-sided cones. Along eruptive fissures where a whole segment erupted, spatter accumulated to produce low ridges called spatter ramparts. Hornitos, also known as rootless vents, are similar in appearance to spatter cones, but formed from spatter ejected from holes in the crust of a lava tube instead of directly from a feeding fissure. The individual globs that comprise the spatter cones, spatter ramparts, and hornitos are frequently not very well adhered to one another and are easily dislodged, making them very vulnerable to human damage.

Four kinds of volcanic "bombs" are found in the Monument; all of which started off as globs of molten rock thrown or ejected into the air. The smaller bombs (backpack size or less) are frequently a target for collection and are now rare in proximity to roads and high-use trails in the Monument. The photo below depicts one type of bomb known as a "bread crust bomb."

Breadcrust Bomb

Caves

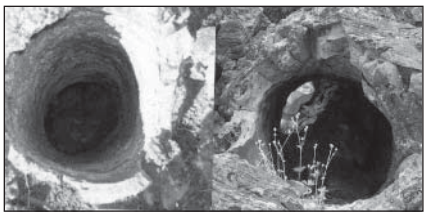
There are many different kinds of caves in the Monument. Shelly pahoehoe areas contain many small open tubes and blisters. There are thousands of these small open tubes and blisters within the Monument. Pahoehoe flows can travel more than 20 miles because the ceilings of lava tube insulate them from heat loss and some of the tubes are greater than 30 feet in height. The photo below depicts one cave known as Indian Tunnel.

Some fissure caves associated with the Great Rift can be passable to hundreds of feet below the surface. Earl (2001) reported at South Grotto in the Kings Bowl Lava Field that the Great Rift can be passable to a depth of at least 650 feet, depending on the internal ice conditions. Bears Den Waterhole, another fissure cave located in cracks of the Great Rift, is ice floored and usually a source of water even in a drought year.

Indian Tunnel Lava Tube

The nature of flowing lava can produce shallow caves and overhangs at flow fronts as a result of inflation processes. Differential weathering of cinder layers on some cinder cones has also generated a few shallow caves. Some of these small caves are more than 10 feet deep.

These various types of caves in



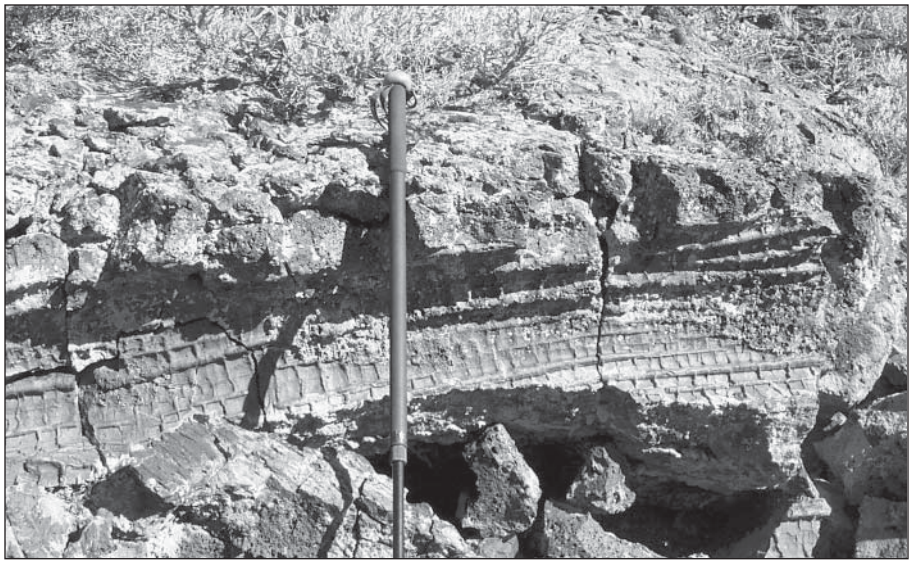


Photo above: Vertical tree mold on left is 8 feet deep and over 1 foot wide; horizontal tree mold on right is almost 2 feet wide. Photo on right: mold of charred wood: hiking staff for scale.

the Monument can also be associated with archaeological and paleontological features, and they can harbor wildlife such as the blind lava-tube beetle, bushy-tailed woodrats, and Townsend's big-eared bats. Deep cracks and fissures, including cracks with likely connections to lava tubes beneath, and the entrances to caves often create or provide microenvironments or microhabitats. Some of these microenvironments support impressive moss, algal, or lichen communities and even ferns.

People are attracted to caves, and some of the easily accessed caves in the Monument now contain considerable graffiti (e.g., Lariat Cave), litter, and other forms of vandalism.

Paleontology

Tree molds are impressions in the solidified lava that form as trees are enveloped by the lava flows, begin to burn, release water and other vapors that quickly cool the surrounding lava, and leave behind a mold of the charred tree and occasionally some carbon residue (see photos). Generally, tree molds preserve impressions of the cracked, partly burnt wood, but do not preserve bark or other textures that would aid in the identification of tree species. In the northern end of the Monument, more than 100 tree molds have been identified. Of the more than 100 inventoried tree molds, 11 showed minor damage from humans, and these were at developed sites.

Animal bones accumulate in lava tubes as inhabitants die naturally and are also introduced into the caves as a result of human or animal disposal. Exploration of such deposits in the lava tubes of the Snake River Plain has revealed bones of extinct animals such as mammoth and camel and modern large animals such as grizzly bear, gray wolf, bison, elk, and pronghorn (Miller 1989). In addition to lava tubes, lava blisters have also accumulated a faunal record. The openings create an excellent trap for larger animals. Carnivores found in these blister traps on the ESRP include the now extinct noble marten and animals no longer found in the area such as bison, wolverine, and Canada lynx (Miller 1989).

A third type of unaltered fossil accumulation occurs in packrat nests. These nests, or middens, are an important contributor to the fossil record because of the ability to date the pollen and bone assemblages and relate that information to the paleoecology of the area.

SOILS

The soils of the Monument area are variable, reflecting the differences and interactions between parent material, topography, vegetation, climate, and time. The most significant differences involve the presence or absence of lava flows and the degree of soil development on volcanic substrates. The lava flows, which occupy two-thirds of the Monument, are made up of basalt lava rock. The soils on the younger basalt flows and cinder beds are limited to the initial decomposition of rock and cinders and

deposition of windblown loess within crevices, cracks, and fissures. Plants can establish and grow in little to no soil. As time progresses, soil development continues and more vegetation establishes.

Sagebrush steppe, mountain areas, and kipukas within the Monument have deeper, well-formed soils. The high desert environment results in lighter colored soils with low organic matter content. Most of the soils in the Monument area are silt loam to sandy loam in texture and vary in depth. They are moderately drained to well drained, except where clay horizons are present. Soils that are disturbed, not properly vegetated, or located on steep slopes are susceptible to water and wind erosion.

Soil Origins

The soils in the Monument and surrounding area have developed from rocks deposited during a sequence of geologic events that began almost 600 million years ago, during the Cambrian Period. For approximately 500 million years, ancient seas intermittently covered the region, depositing limestone and other sedimentary rocks typical of ocean floors (Shallat and Burke 1994). Beginning about 17 million years ago, fault block mountain building has pushed up the rocks, exposing them to weathering and soil development processes. The many mountain ranges in the Basin and Range Province have developed in this way. Recent earthquake activity is evidence that these mountain-building processes continue today.

During the latter part of the Tertiary Period, from about 16 million years ago, until recently in the Yellowstone area, explosive volcanic activity across the Snake River Plain deposited layers of pyroclastic tuffs and silica rich lavas. More recent basalt lava flows and windblown loess have subsequently covered these rhyolite rocks. The basalt flows that are visible on the surface of the majority of the Snake River Plain began approximately 2 million years ago, during the Pleistocene, and continued until very recent times.

The lava flows on the Snake River Floodplain are approximately 1 million years old (Anderson et al. 1996). This volcanic activity built up the central part of the plain, forming some internally drained basins within, such as Big and Little Lost River sinks.

During recent times, the region has periodically received layers of windblown dust from sources further west. These loess deposits have mantled the local geology and have resulted in many of the deeper soils on the eastern Idaho foothills and the leeward sides of lava flows within the Snake River Plain.

Soil Types

Soil surveys have been completed and published by the Natural Resource Conservation Service (NRCS) for most of the Monument outside of the recent lava. Other portions of the area have been partially mapped at different times by the Bureau of Land Management (BLM) in the late 1980s and 1990s. Many of the soils surveys are now in Geographic Information System (GIS) form, where they can be viewed in Arcview and other GIS software.

Soil types in the Monument fall into the following categories:

- Soils of the Mountains and Foothills – These soils are located primarily in northern part of the Monument. They have developed in mixed metamorphic and/or volcanic shallow, rocky material and have carbonate accumulations at depth. Typical vegetation includes sagebrush, mountain shrubs, and trees found native to eastern and southern Idaho.
- Soils of Alluvium from the Mountains and Streams – These soils have developed in lime-rich alluvial materials eroded from the mountains on the Snake River Floodplain and streams. Typical shrub vegetation includes mountain or Wyoming big sagebrush, low sagebrush, and occasionally some basin big sagebrush.
- Shallow Basalt Soils – This is a complex of soils developed on the recent basalt flows. Due to the uneven, broken surface of the basalt, soil depths range from a few inches on exposed ridges to 6 or 8 feet on the lee

sides of the ridges and in low-lying areas. The type of vegetation varies depending on soil depth and may include various types of shrubs including fern-bush, syringa, and mountain big sagebrush, with some low and Wyoming big sagebrush.

- Loess Soils – The loess soils are from glacial Snake River silts and lacustrine materials that have been windblown out of the Snake River drainage. Typical shrub vegetation includes mountain big sagebrush, Wyoming big sagebrush, basin big sagebrush, or some threetip sagebrush.
- Sandy Soils and Playa Lake Bottoms – These soils have formed in alluvial and eolian accumulations usually near dry lake bottoms. The sands have weathered from quartzite, basalt, and sedimentary rocks, generally of local origin (Nace et al. 1975). Typical shrub vegetation includes basin big sagebrush or Wyoming big sagebrush.
- Cinder Soils – This is a complex of soils mapped by NRCS and particular to cinder cones and deposits located within the Monument. Soils within this complex consist of varying ratios of cinder and eolian loess accumulations. Typical vegetation includes dwarf buckwheat, antelope bitterbrush, mountain big sagebrush, and limber pine.

Biological Soil Crusts

Biological soil crusts are a feature common to nearly all plant communities in arid and semiarid regions throughout the world (Belnap et al. 2001). The development of biological soil crusts is dependent on a number of factors, including soil texture and chemistry, annual precipitation amount and timing, associated vegetation, and disturbance history. Biological soil crusts have not been observed as a highly conspicuous element in the Monument, which could be due to any one of these factors.

Soil textures in the Monument range from fine- to coarse-textured, with silt loams and sandy loams being predominant in areas where biological soil crusts are most likely to occur. Coarse-textured soils are more difficult for biological crusts organisms to stabilize due to the size of the particles. While crusts occur on soils with a variety of chemical natures, they tend to be highly developed on soils with basic pH and that are more saline or calcareous. Mosses are often a dominant organism on soils with neutral to acidic pH. Annual precipitation in the Monument averages from 8 to 16 inches. Areas with approximately 14 inches of annual precipitation have vegetation of a density where crusts are no longer needed to stabilize the soil surface.

The presence or absence of biological soil crusts on the Monument landscape depends on a variety of environmental factors as well as land use and fire history. While several BLM-administered areas and some kipukas in the Monument do not show good development of biological soil crusts, more areas, particularly in the drier southern portions, need to be investigated to determine the potential for crusts development. For example, areas with non-sprouting basin and Wyoming big sagebrush need to be compared with similar areas supporting the re-sprouting threetip sagebrush to determine if areas with a naturally shorter fire cycle (as indicated by the re-sprouting shrub) might have less potential for crust development than areas with longer historic fire return intervals.

VEGETATION, INCLUDING SPECIAL STATUS SPECIES, AND FIRE MANAGEMENT

Although some of the younger lava flows are devoid of vegetation, there is a surprising diversity of plants and plant communities in the Monument (see Appendix D). The type and density of vegetation varies widely, depending on the availability of soil. The lavas and kipukas (islands of vegetation surrounded by younger lava flows) show a full range of ecological succession – from pioneer plants, such as lichens and mosses on the basalt surfaces, to complex plant communities in the kipukas and rangelands bordering the lava flows. The rough topography of the lava flows creates numerous microsites where soil and water accumulate to support plants that would normally occur in higher precipitation zones.

Limber pine stands occur on the cinder cones and lava flows in the northern part of the Monument. The transition between limber pine and juniper vegetation types occurs between Blacktail Butte and the original Monument. This ecotone normally occurs only in montane regions and is thus an unusual feature for the lava flows (USDI BLM 1980b). Quaking aspen and Douglas fir stands are found on some north-facing slopes in the northern portion of the Monument. Riparian and wetland habitats are limited to the northern periphery due to the geology, topography, and climate of the area.

Early successional plant communities on the cinder cones produce stunning spring wildflower displays. Areas with greater soil development support the sagebrush steppe vegetation that typifies the Snake River Plain. Sagebrush steppe is found on approximately 60 percent of the Monument and covers the more developed soils of the rangelands, kipukas, cinder cones, older lava flows, and the foothills of the Pioneer Mountains. This once was the most common vegetation throughout the Snake River Plain, as well as in the Intermountain West and Upper Columbia River Basin. However, fire, agriculture, and livestock grazing have modified composition and reduced the extent of this vegetation type throughout these regions (Blaisdell et al. 1982; Whisenant 1990; Bunting et al. 2002).

Some of the kipukas and portions of the original Monument have not been grazed by domestic livestock and have seen little in the way of other human-related disturbances. Thus, these areas, which are protected by new, rough lavas, offer some of the best remaining examples of native sagebrush steppe for the Snake River Plain. They are valuable as examples of range conditions before European-American settlement and the introduction of domestic livestock, and they offer an opportunity to observe climax vegetation, as well as successional processes associated with natural disturbances such as fire.

Vegetation in the original Monument and parts of the expanded Monument has been inventoried and mapped through various efforts (Day and Wright 1985; Whipple 1992; Jurs and Sands 2004). A recent vascular plant inventory effort estimates the presence of more than 600 species and at least 35 vegetation communities within the Monument (NPS, unpubl. data). The current vegetation map of the Monument was created with the use of LandSat imagery.

Data from the various vegetation studies, as well as inventory and monitoring points, were used to define spectral signatures. Vegetation inventory and ground-truthing of the map are ongoing; the vegetation map is a dynamic resource. This map, which is relatively broad in scale, is intended to provide a frame of reference for vegetation distribution and diversity within the Monument. The following discussion describes complexes that group and define the various vegetation types illustrated on the map (Figure 12).

Vegetation Types in the Monument

- **Vegetated Lava Complex**
  Exposed lava flows are the newest lava flows or rough A'a flows that are mostly devoid of vascular plants; however, lichens and mosses are frequently present. Based on statewide Gap Analysis of Idaho Land Cover from 1996, approximately 20 percent of the Monument is exposed lava flows and 33 percent is vegetated lava (Landscape Dynamics Lab 1999). Vegetated lava is defined as lava fields with greater than 5 percent total vegetative cover, with plants occurring as islands, pockets, or clustered individuals in the lava flow. The vegetated lava complex mainly consists of early successional and adaptable plants that grow in the limited soil that blows into the cracks and fractures on young basalt rock.

  The type of lava and the amount of soil determine the type and density of vegetation. Penstemon and gland cinquefoil grow in shallow soils, while fern-bush, rock spirea, and syringa are present in deeper crevices. Trees, such as limber pine in the north end of the Monument and juniper in the south

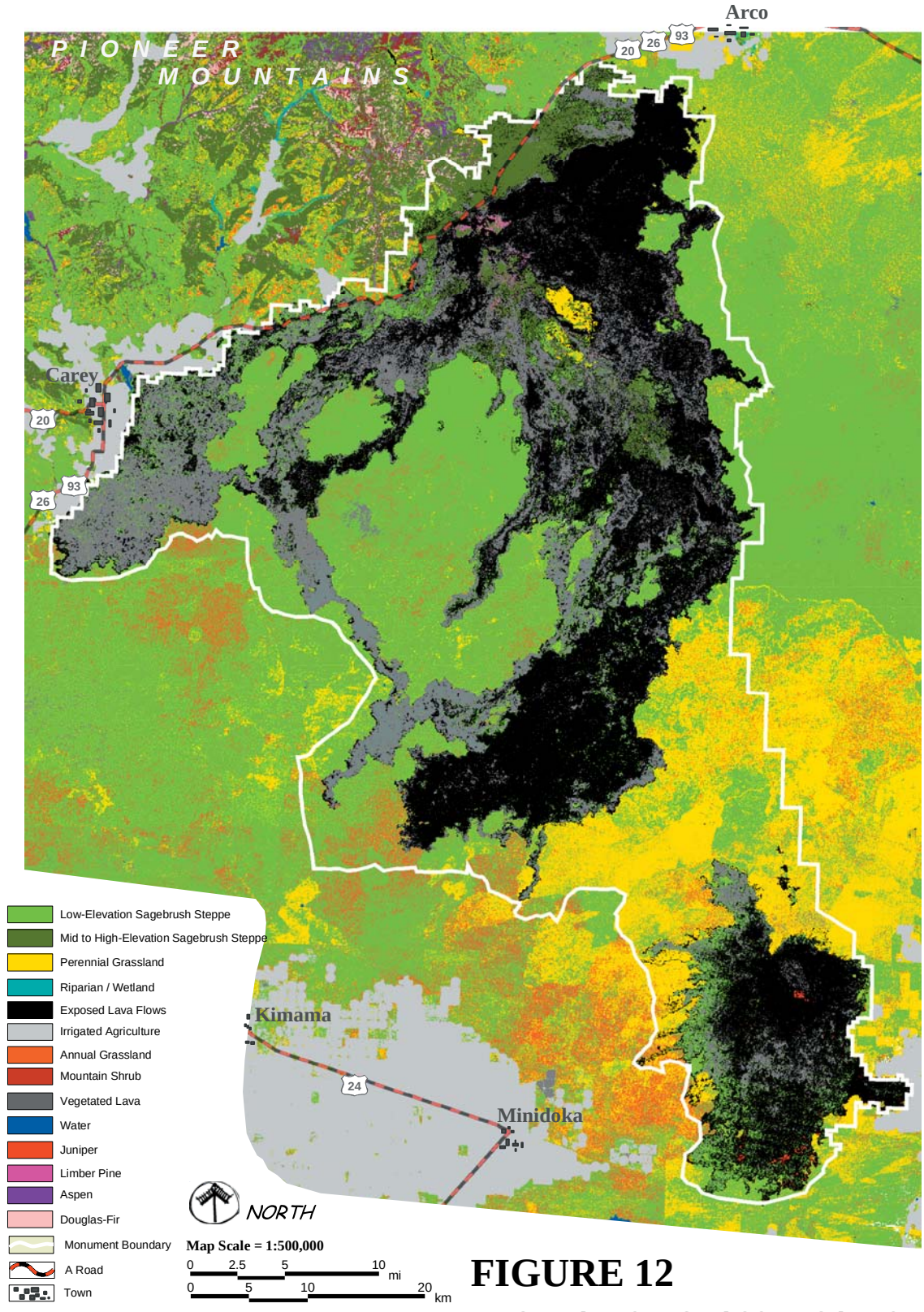


FIGURE 12

VEGETATION CLASSIFICATION

Craters of the Moon National Monument & Preserve

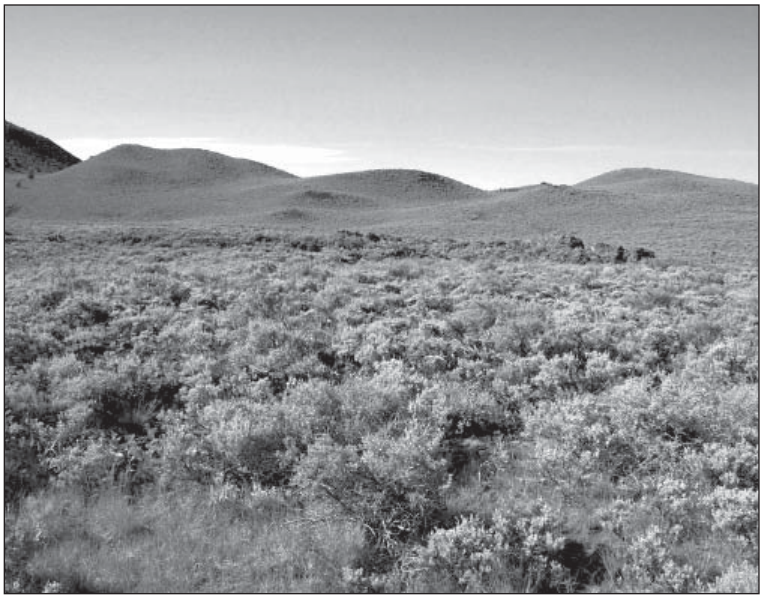
U.S. Department of the Interior * National Park Service * Bureau of Land Management

These vegetation data were derived from 30m satelite imagery and is intended to provide a general frame of reference for vegetation distribution and diversity for the Monument. No warranty is made by the Bureau of Land Management or National Park Service for use of the data for purposes not intended by these agencies.

end, also grow in crevices and cracks where sufficient moisture is funneled and retained. These trees may grow as scattered individuals or as small woodlands. Antelope bitterbrush, rabbitbrush, and sagebrush can also be found (up to 15 percent vegetative cover) where more soil development or deposition has occurred.

- **Sagebrush Steppe Complex**
  Sagebrush steppe, which is the dominant vegetation in the Monument, includes all areas where adequate soil deposition or development has occurred to allow sagebrush taxa and associated shrubs with a bunchgrass understory to dominate. Due to the drastic reduction of sagebrush steppe in southern Idaho by cultivation, fire, and weed invasion (Hironaka et al. 1983), some of the sagebrush communities in the Monument are the best remaining examples of this vegetation type on the Snake River Plain.

  The sagebrush steppe appears to be a monotonous landscape; however, there is a remarkable diversity of plant and community types. Many factors influence the diversity, density, cover, distribution, and health of this high desert sagebrush steppe, including differences in soil depth and development; the precipitation gradient ranging from 8 to 16 inches; the elevation gradient ranging from 4,000 to 7,500 feet between the southern and northern ends of the Monument; historical and current land management; invasive species; and fire frequency. In turn, vegetation structure and composition influence the ability of the community to resist invasive species infestation; its susceptibility to, as well as recovery from, fire; and land management goals,



Top photo: Lava vegetated with sagebrush and fern-bush. Center photo: vegetated lava complex. Bottom photo: Low-elevation sagebrush steppe

decisions, and practices imposed upon the landscape

Sagebrush steppe vegetation in the Monument occurs over an elevation gradient and is dominated largely by three subspecies of big sagebrush – mountain big sagebrush, basin big sagebrush, and Wyoming big sagebrush – as well as threetip sagebrush. The Mid- to High-Elevation Sagebrush Steppe vegetation type is generally defined by the presence of mountain big sagebrush and antelope bitterbrush, which occur in the higher elevation areas of the northern Monument that are colder and receive more precipitation. Low sagebrush is also found in this vegetation type, occurring in a mosaic with mountain big sagebrush.

The Low-Elevation Sagebrush Steppe vegetation type is defined by basin and Wyoming big sagebrush and threetip sagebrush, although these may overlap to some extent with the mid-elevations. Both basin and Wyoming big sagebrush are adapted to the hot, seasonally dry conditions of the Snake River Plain. Basin big sagebrush communities occur in pockets of deeper, more fertile soils. Wyoming big sagebrush communities tend to be found in shallower soils and can be found intermixed with basin big sagebrush.

Threetip sagebrush is widespread throughout the Monument, particularly in areas burned within the last 20 years. Threetip sagebrush is the only sagebrush found in the Monument that re-sprouts following fire. Both the Low- and Mid- to High-Elevation Sagebrush Steppe vegetation types contain other common shrubs such as antelope bitterbrush, rubber rabbitbrush, and green rabbitbrush.

Understory components in the sagebrush steppe complex vary widely in type and abundance, but common species include Sandberg bluegrass, Idaho fescue, needlegrasses, bluebunch wheatgrass, and the exotic annual cheatgrass. Forbs such as buckwheats, arrowleaf balsamroot, lupine, phlox, and milkvetches are also commonly found growing in these vegetation types. Both diversity and abundance of herbaceous plants increase with increasing elevation and moisture in the Monument.

The reduction of large tracts of sagebrush through increased size and frequency of wildfires is a concern in the area. Less obvious is the loss of native understory plants, particularly native bunchgrasses that are valuable components to the ecosystem. Plants such as bluebunch wheatgrass and Idaho fescue may not be resilient under conditions of closed shrub communities, frequent fire regimes, cheatgrass invasion, altered climate or site conditions, or excessive grazing. The reduction in these native species by one factor increases their susceptibility to other factors. Once native understory species are excluded, they are very difficult to reestablish (Hironaka et al. 1983).

The variation of sagebrush steppe communities influences the multiple values and uses of this landscape in the Monument. These areas are valued as crucial winter range habitat for mule deer and pronghorn, essential habitat for sagebrush-obligate wildlife such as sage-grouse, important watersheds, sources of forage for livestock, and enjoyable recreational sites. There is a range of conditions, primarily due to relative isolation and past and present land uses.

The Monument contains more than 500 kipukas, many of which contain relatively undisturbed native sagebrush steppe communities. Fire, livestock grazing, recreation, or cheatgrass invasion has altered some of the kipukas; however, other kipukas in the Monument have been protected from access and buffered by rough lavas. The abundance and condition of resources within most these

kipukas is undocumented and relatively unknown. However, for those kipukas that have been documented and studied, it is clear that these unique islands of nearly pristine native vegetation are important rangeland and scientific benchmarks (Henderson and Murie 1958; Yingst and Handy 1961; Tisdale et al. 1965; Caicco and Wellner 1983a, 1983b, 1983c).

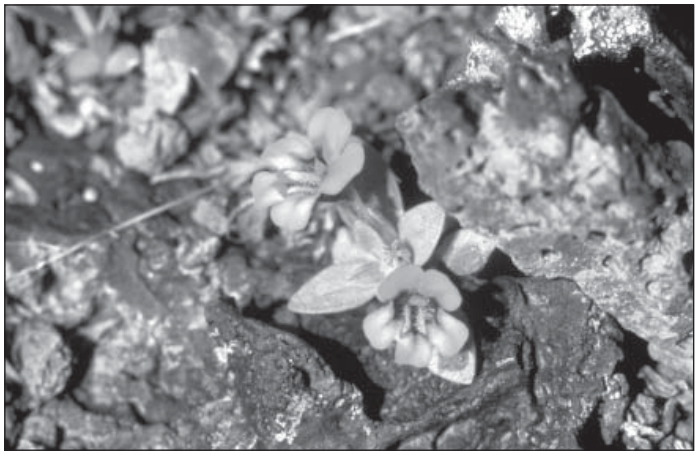
The Monument also includes parks. Laidlaw Park, Paddelford Flat, and Little Park technically meet the definition of a kipuka, but are referred to as "parks" due to their larger size, accessibility, and land use. There is road access to and within these parks, and livestock grazing is a current and historical use. All three parks contain the Low-Elevation Sagebrush Steppe vegetation type, as well as areas dominated by annual and perennial grasslands. The abundance of native species and the quality of these sagebrush steppe communities depends mainly on management practices and cumulative effects of environmental responses. For example, the northern parts of Laidlaw Park have not been overgrazed; retain sufficient native understory and sagebrush; and support big game as well as sage-grouse. However, historic overgrazing, frequent wildfires, Aroga moth infestations, cheatgrass invasion, and noxious weeds have negatively affected the southern portions of Laidlaw Park. In addition, the southern part of the park receives slightly less rainfall than the northern part, making it less resilient to disturbance (Jurs and Sands 2004).

Perennial grassland in Sand Kipuka.

- **Grasslands Complex**
  The Perennial Grassland vegetation type is dominated by native or introduced perennial grasses. Historically, these grasslands were part of the sagebrush steppe complex and formed as a result of disturbance, primarily through fire. Shrubs would eventually reinvade perennial grasslands if they remained unburned for several decades. In most cases, fire is the main cause of shrub removal. Some shrubs such as mountain big sagebrush, threetip sagebrush, rubber rabbitbrush, and green rabbitbrush are able to re-sprout or reestablish within a short time (10 years). However, Wyoming and basin big sagebrush must regenerate from seed and can be slow to reestablish after fire. The Annual Grassland vegetation type is the result of altered disturbance regimes, such as soil surface disturbance or frequent fires in areas with long natural fire return intervals. The primary component is cheatgrass, an exotic species that perpetuates short fire-return intervals and conditions that maintain its dominance.

  In many cases, microsite conditions have often been altered to the extent that native grasses are unable to effectively compete with cheatgrass and noxious weeds. Under these conditions, managers revegetate burned areas by seeding perennial vegetation to prevent the establishment of annual grasslands. In areas where altered site conditions and high compe-

tition from exotic species exist, select cultivars of introduced and native perennial grasses and forbs are used to rehabilitate burned areas. Some of the species seeded in rehabilitated areas are crested or Siberian wheatgrass, Snake River wheatgrass, tall wheatgrass, big bluegrass, and Sandberg bluegrass. Forbs such as blue flax, sainfoin, and alfalfa have also been seeded. Exclusively native plant seedings have also been conducted to a limited extent. Both the NPS and BLM encourage the use of native species for restoration and rehabilitation efforts.



Dwarf Monkeyflower

- **Mountain Complex**
  The complex of mountain vegetation occurs at the far north end of the Monument in the foothills of the Pioneer Mountains. This complex covers less than 1 percent of the Monument, but it includes vastly different and important habitat types that contribute to its diversity.

  Five vegetation types are included in this complex. The Douglas fir type is found on relatively steep, north-facing slopes of older cinder cones and along Little Cottonwood Creek. The Aspen type is predominantly found in upland sites away from permanent stream courses. The Riparian type is characterized by dense woody vegetation such as black cottonwood, chokecherry, willow, alder, and a dense layer of tall forbs close to permanent watercourses. The Mountain Shrub vegetation type includes communities dominated by mountain big sagebrush, low sagebrush, and mountain snowberry that occupy slopes and ridges of the Pioneer Mountains. The Wetland type predominantly occurs along the periphery of the Monument where this vegetation is supported by cold water and Mountain vegetation complex north of the highway.

Mountain vegetation complex north of the highway

  Human-based activities (e.g., water right diversions, livestock grazing, thermal spring recreation), in the past and present, have degraded the Riparian and Wetland types. For example, early 20th century mining, fire suppression, and NPS spring diversions in Little Cottonwood Creek, facility development, and maintenance activities may have altered the plant species composition and influenced the spread of Canada thistle. NPS facilities recently converted to well water and reinstated full spring flow to Little Cottonwood Creek.

- **Cinder Cone Complex**
  This complex is located in the north end of the Monument, south of the highway, where many cinder cones are present. This area is mapped primarily as the Vegetated Lava, Limber Pine, and Mid- to High-Elevation Sagebrush Steppe types. The cinder cone complex includes three

different plant communities, depending on aspect, soil development, and successional stage. Less than 1 percent of the Monument is cinder gardens. Cinder gardens occur on cinder deposits with little to no soil development. These communities produce spectacular spring wildflower displays and are dominated by dwarf buckwheat, scorpion weed, Douglas chaenactis, dwarf monkeyflower, and bitterroot. As soils develop on the cinders, antelope bitterbrush dominates newly establishing mid- to high-elevation sagebrush steppe communities.

Cinder Cone Complex

The Limber Pine type is present on north-facing slopes where sufficient moisture is available. Limber pine stands with antelope bitterbrush understory provide valuable wildlife habitat and are used by mule deer for fawning. Attempts were made in the 1950s to eradicate native dwarf mistletoe from the limber pine population. More than 6,000 trees were cut or poisoned until managers realized that limber pine and mistletoe had coexisted for thousands of years. The effects of this action have not been studied and are not understood; however, there was a change in the population and age structure of the limber pine forest (Blakesley and Wright 1988).

- **Nonvascular Plants**
  Mosses, liverworts, lichens, and fungi are vegetative life forms that have been historically overlooked in the Monument flora due to their inconspicuous nature. These organisms occur to some extent in every vegetation type occurring in the Monument and are commonly observed on exposed lava. This large group of organisms has been studied to some degree in other areas, but limited information exists for the Monument area specifically. Nonvascular plants perform a number of ecologically important functions – they actively decompose detritus, break down rock, and add structure and nutrients to the soil. They are important components of the functioning ecosystem and also serve as environmental quality indicators. Diffuse knapweed, a state-listed noxious weed occurring in the Monument

Noxious and Exotic Species
Ten species of weeds designated as noxious by Idaho State Law (State of Idaho 2001) have been identified in the Monument: spotted knapweed, diffuse knapweed, Russian knapweed, rush skeletonweed,

leafy spurge, Canada thistle, musk thistle, Scotch thistle, dalmatian toadflax, and field bindweed. Disturbed areas such as road rights-of-way, intensively grazed areas, and burns are particularly susceptible to invasion by exotics; consequently, most of the noxious weeds are found specifically in these areas. No noxious weed infestations have currently been documented on the few inventoried kipukas in the Monument.

Spotted knapweed and diffuse knapweed have been documented extensively along U.S. Highway

Diffuse knapweed, a state-listed noxious weed occurring in the Monument

20/26/93 (US 20/26/93) along the northern extent of the Monument. More than 200 infestations of these knapweeds occur along the highway within Monument boundaries. NPS mapped and treated these locations in 2001 and 2003 as a partner in the Lost Rivers and Blaine County Cooperative Weed Management Areas. Spotted and diffuse knapweeds have also been documented and treated in Paddelford Flat and Laidlaw Park, along the west and east edges of the Monument, respectively.

Rush skeletonweed has been reported in approximately 10 locations in Laidlaw Park and the west side of the Monument; approximately 18 locations have been documented in the Bear Trap Cave and Kings Bowl vicinities along the east side of the Monument. Many observations of this species have not been documented. This weed also takes advantage of disturbed soil and spreads primarily by seed. It is reported to be the most invasive (rapidly spreading) noxious weed in recent years within the Monument.

Leafy spurge has been documented in the west part of the Monument as small, scattered sites within the sagebrush steppe and vegetated lava (Carey Lava Field). It has also been recently documented in the group campsite north of the highway. Large infestations are known to exist along the west edge of the Monument in the Carey area and in the Monument Butte and Sand Butte vicinities. These large infestations have increased the potential for further introduction and spread onto the Monument via bird, deer, livestock, and vehicles. BLM is continuing a successful 10-year control program specifically developed to address infestations on lava-based terrain.

Thistles are found in scattered locations in the North Unit, Laidlaw Park, and along the west and east edges of the Monument. Approximately 75 total infestations have been documented for all three noxious thistles.

Both BLM and NPS have initiated integrated noxious weed programs. Efforts to control these species are in effect, including the use of mechanical and spray techniques, as well as limited use of biological control agents. The priority species discussed have been targeted specifically for mapping, treatment, and prevention programs. Education and public awareness are emphasized by both agencies. Involvement in Cooperative Weed Management Areas has resulted in strong community commitment and cost-effective management of noxious weeds.

Other invasive exotic species, such as cheatgrass, are as much of a concern as state-listed noxious weeds. Cheatgrass, a common and widespread invader throughout the West, was introduced in the early 1900s when domestic sheep grazed the area. Cheatgrass is extremely competitive and readily invades and dominates disturbed land. It can be a component of undisturbed or otherwise healthy sagebrush. For example, cheatgrass has been documented in several kipukas that lack a history of common human disturbances such as livestock grazing. This annual grass out-competes native vegetation and perpetuates a frequent fire regime, which further discourages the regrowth of native species and encourages more cheatgrass. This has been a key management concern for BLM and has driven the development of more effective disturbed land rehabilitation and restoration techniques. Approximately 80,000 acres of annual grassland and low-elevation sagebrush steppe dominated by cheatgrass have been identified in the Monument as needing management intervention to restore functional sagebrush communities.

BLM and NPS have implemented nationwide policies against invasive and harmful exotic species. All the species mentioned in this discussion have been targeted for eradication or control.

Fire and Vegetation Management

Between 1970 and 2002, approximately 330,000 acres have burned in wildfires within the boundary of the expanded Monument, primarily on BLM-administered land. About a third of this acreage has burned two or more times (Figure 13).

Peak fire years occurred in 1971 (29,000 acres), 1981 (22,000 acres), 1992 (61,000 acres), 1996 (31,000 acres), and 1999 (87,000 acres). Extensive acreages outside of and adjacent to the Monument also

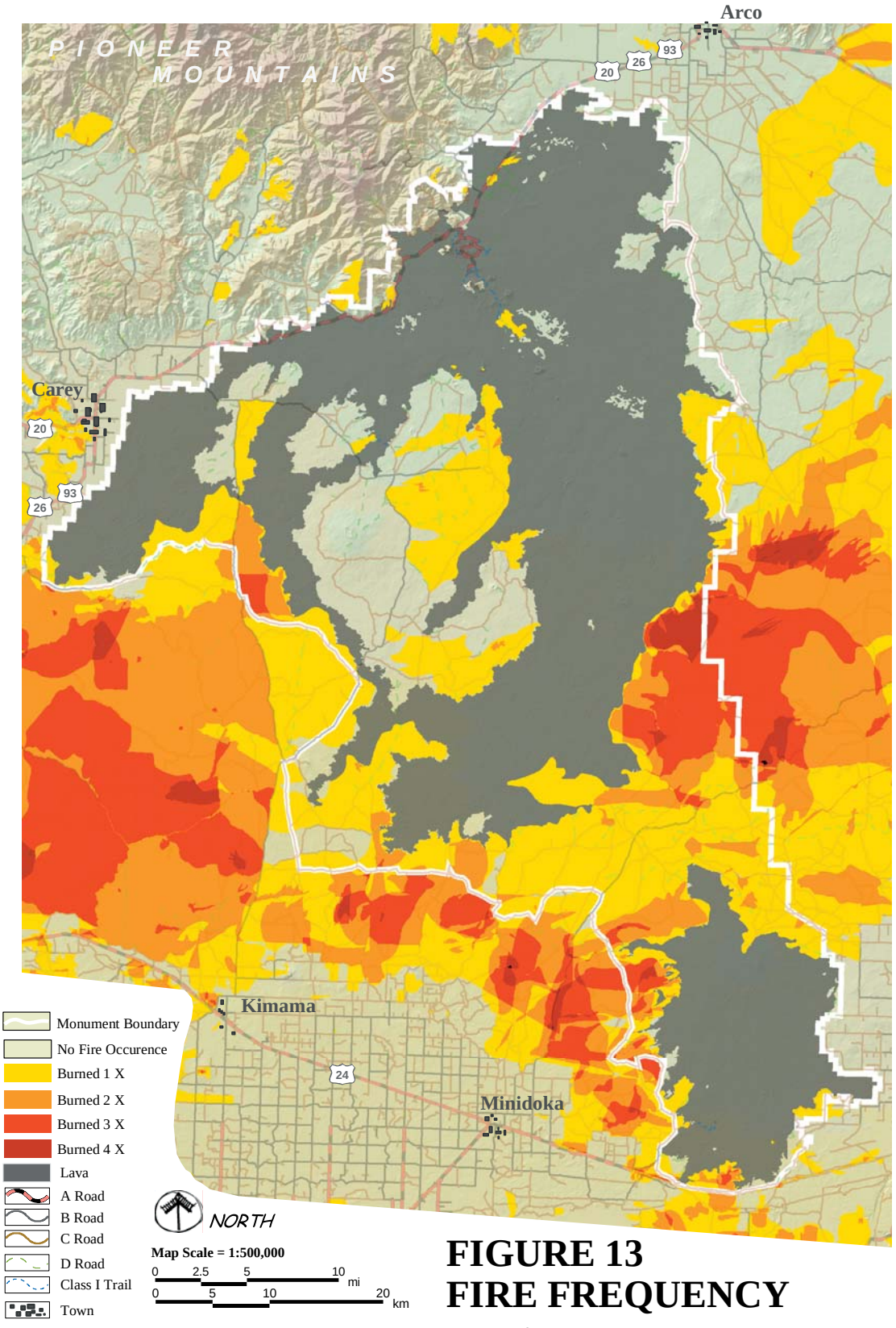


FIGURE 13
FIRE FREQUENCY

Craters of the Moon National Monument & Preserve

U.S. Department of the Interior * National Park Service * Bureau of Land Management

No warranty is made by the Bureau of Land Management or National Park Service for use of the data for purposes not intended by these agencies.

Fire in low-elevation sagebrush steppe dominated by cheatgrass.

burned during this period. About half of Laidlaw Park and Paddelford Flat and nearly all of Little Park have remained unburned in the last decade. Relatively small fires have burned on vegetated lava and in kipukas, notably Little Prairie in 1992 (1,900 acres) and Echo Crater in 2000 (632 acres). Overall, fires within the original NPS Monument boundaries represent only 8 percent of the total area burned since 1970.

As previously noted, fire plays a key role in determining the diversity and condition of vegetation communities. Large tracts of sagebrush have been lost due to extensive wildfires, and fires have perpetuated exotic annual grasslands. However, fire also plays an important role in the maintenance of some vegetation types, including aspen and mountain shrub.

Native Americans historically used fire to manipulate vegetation and wildlife (Williams 2001). Since the mid-1800s, sheepherders used fire in the Monument to reduce shrub cover and encourage herbaceous plant growth. Good fire records prior to 1950 are not available; however, traditional practices throughout southern Idaho are known to have included the use of fire to eliminate sagebrush and promote grass growth. In 1982, the BLM proposed to burn approximately 19,000 acres to break up continuous tracts of sagebrush; create more diverse wildlife habitat; reduce fuel loads; and improve forage for domestic livestock and wildlife (Saras 1982).

The burning of approximately half of this acreage was accomplished by 1992, at which time large wildfires occurred in the area and the use of prescribed fire was curtailed. The use of prescribed fire was re-initiated in 2001, when small areas within the Monument (part of larger projects near the southern boundary) were burned to reduce cheatgrass, in conjunction with herbicide and seeding treatments.

The length and timing of the fire season is highly dependent on annual weather and fuel conditions. Generally, the season can extend from mid-May through mid-October. Warm, dry, and windy weather associated with thunderstorm cells can result in lightning activity with or without rain. Ignition of vegetation can occur from natural sources, primarily lightning, or from human sources such as vehicles, campfires, or cigarettes.

Areas most at risk for large, destructive wildfires are the rangelands in the southern part of the Monument where fuel loading is high due to an abundance of cheatgrass in the understory. Ignitions on vegetated lava are rare; however, there is a risk that fires near the edge of the lava can lie low for a period of time and then ignite adjacent rangelands if weather conditions become hot or windy. Fires in kipukas remain localized and small, because the surrounding lava limits spread.

The northern end of Laidlaw Park, in particular, and other isolated areas in the Monument contain good examples of sagebrush steppe vegetation, which could potentially be lost or degraded by invasive or noxious weeds following a fire. In areas of the Monument north of the highway, mountain shrub, aspen, and Douglas fir communities might benefit somewhat from fire; however, watershed protection in Little Cottonwood Creek (which provides potable water in the Monument) and the protection of research and group campsite facilities necessitate aggressive suppression.

Fire management in the Monument is directed by

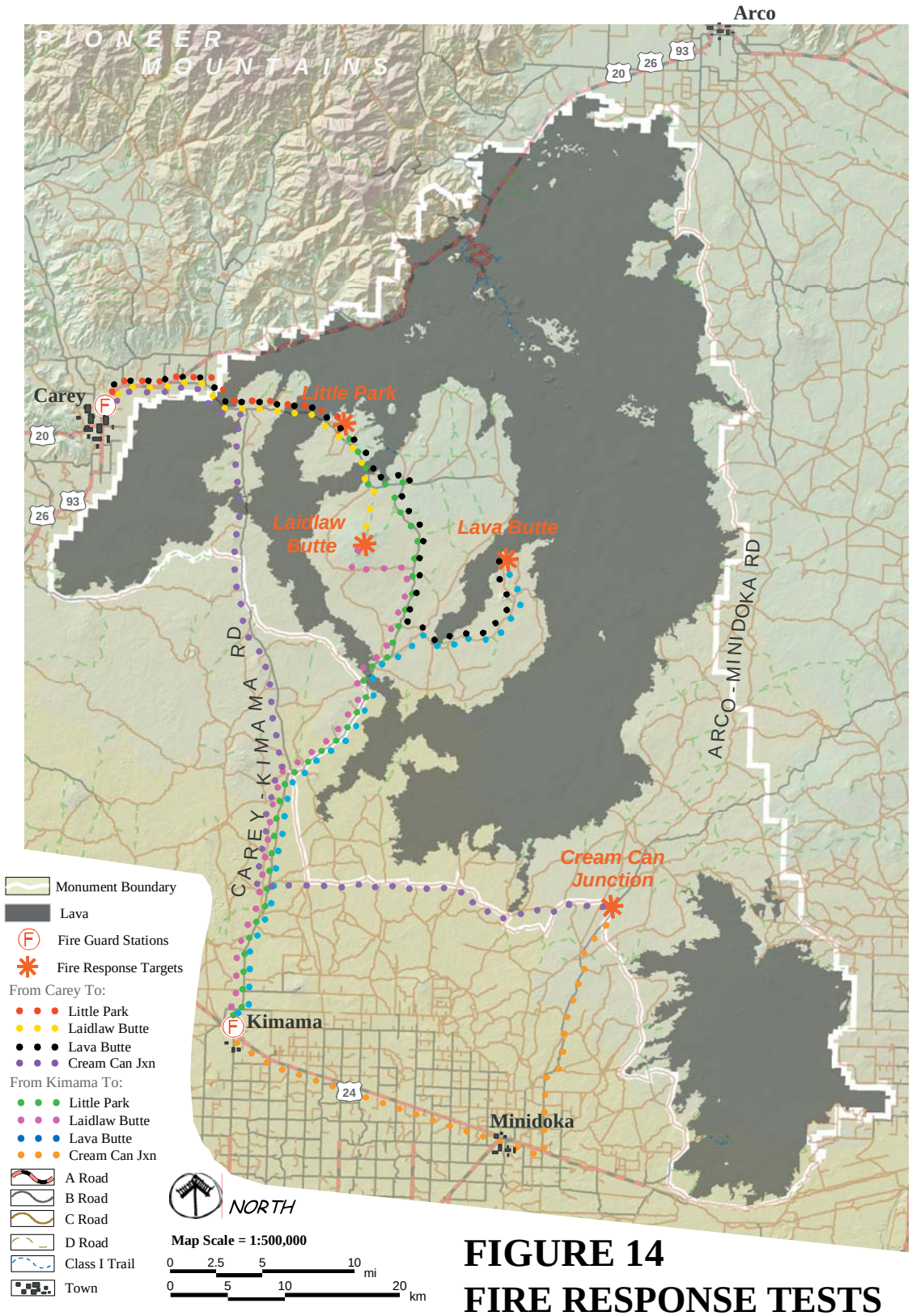
the current BLM Land Use Plans, the Fire Management Plan for South Central Idaho (USDI 2004), and the NPS Craters of the Moon National Monument Wildland Fire Plan within the original Monument boundaries (USDI NPS 2000a). Under these plans, all wildfires are suppressed except for naturally ignited fires in designated wilderness, which may be managed for resource benefit (also known as wildland fire use).

Fire suppression response in the Monument varies depending on the location of the fire, terrain (roughness and slope), weather (especially wind speed and direction), fuel type and moisture, and potential resource damage. While suppression response usually includes both aerial and ground support, this can vary if there are multiple incidents at the same time. In summer/fall 2005, fire personnel performed an exercise which determined travel times to selected areas in the Monument for fire response. Two-person teams drove heavy engines from the Carey and Kimama Guard Stations to predetermined sites within the Monument. Table 10 summarizes travel time, as well as the miles of road by class for each route. Figure 14 shows the site locations relative to the road network. In general, average speed on paved highways is approximately 60 mph, on Class B roads is 40 mph, on Class C roads is 25 mph, and Class D roads is 15 mph. Average speed, especially on Class C and D roads, will vary depending on roughness of terrain.

Rate of fire spread is dependent on numerous variables, including fuel type and moisture, wind speed and direction, and slope. The Behave fire modeling system was used to estimate potential fire growth in the general area encompassing the selected geographic points. Type of fuel, fuel moisture, and wind speed were the parameters included in the model. The vegetation at the selected points is generally represented by two fuel models. Fuel Model 2 represents a grass community with a shrub component; Fuel Model 5 represents a low to moderate height shrub community. The dry fuel moisture regime represents conditions during the peak of the fire season (mid-July through early October) with temperatures of 90-100 degrees Fahrenheit and relative humidity of 10-19%. The moderate fuel moisture regime represents conditions that are more typical early in the fire season (May through early July) with temperatures of approximately 75-85 Fahrenheit and relative humidity in the mid-20s. Table 11 summarizes the results of the modeling exercise. Wind speeds of 10 and 20 mph are presented for comparison. Wind speed of 10 mph represents relatively typical conditions, while 20

Table 10
Results of Fire Response Time Exercise, Including Travel Time and Mileage by Class of Road

END LOCATION	TRAVEL TIME IN MINUTES	MILEAGE BY ROAD CLASS			
		A	B	C	D
Carey Guard Station to Location					
Little Park	34	4	9	1	0
Laidlaw Butte	57	4	14	0	3
Lava Butte	97	4	25	12	0
Cream Can Junction	120	4	32	20	0
Kimama Guard Station to Location					
Little Park	51	0	39	1	0
Laidlaw Butte	56	0	29	3	2
Lava Butte	57	0	24	12	0
Cream Can Junction	60	17	16	0	0



This map illustrates 8 routes taken by BLM fire crews for documenting fire response times to four separate locations as described in the fire management section of chapter three. No warranty is made by the Bureau of Land Management or National Park Service for use of the data for purposes not intended by these agencies.

FIGURE 14
FIRE RESPONSE TESTS

Craters of the Moon National Monument & Preserve

U.S. Department of the Interior * National Park Service * Bureau of Land Management

Table 11
Results of Generalized Fire Growth Modeling for Vegetation in the Monument Using Two Fuel Models, Two Fuel Moisture Regimes (See the Text for Definitions of Each), and Two Wind Speeds

MODELING PARAMETERS	ELAPSED TIME (HOURS)					
	0.5	1	1.5	2	2.5	3
Fuel Model 2	Fire size in acres					
Dry 10 mph	159	634	1,427	2,537	3,964	5,708
Dry 20 mph	1,107	4,428	9,962	17,710	27,673	39,849
Moderate 10 mph	74	296	666	1,184	1,850	2,664
Moderate 20 mph	517	2,067	4,650	8,266	12,916	18,599
Fuel Model 5						
Dry 10 mph	52	210	472	839	1,311	1,887
Dry 20 mph	201	804	1,809	3,216	5,025	7,236
Moderate 10 mph	6	25	55	98	153	221
Moderate 20 mph	18	71	159	282	441	635

mph represents extreme conditions.

Although the fire growth models are simplified compared to the conditions that actually occur during a fire incident, they demonstrate the high level of variability resulting from differences in fuel type, fuel moisture, and wind speed. This variability is a consideration for both fire management and transportation/access planning.

Fire and Related Vegetation Management

Federal wildland fire policy (USDI and USDA 1995; USDI et al. 2001; USDI 2003) focuses on protecting sensitive resources while using fire along with other treatments (such as herbicides and seeding) to achieve desired future conditions for vegetation resources. Currently all federal land management agencies are implementing, or preparing to implement, this policy through a Cohesive Strategy (Laverty and Williams 2000). This strategy presents guidelines for reducing wildland fire risk to human communities and to restore and maintain ecosystem health within fire-prone areas. The Cohesive Strategy is based on the concept of restoring vegetation composition and structure (and thus fire regimes) to historical levels. As part of this process, three Fire Condition Classes (FCC1 through 3) have been identified to help clarify the degree to which a particular vegetation community departs from its historic fire regime, as described below:

- **FCC1** represents low departure from the historic fire regime. Key ecosystem components include a healthy mosaic of various successional stages for each vegetation type. For example, these components would include sagebrush steppe communities with native perennial grass and forb understories, or aspen or Douglas fir communities with trees of variable age, openings to allow tree regeneration, and an abundance of understory grasses and forbs.
- **FCC2** represents moderate departure from the historic fire regime, resulting in some risk of more frequent fire return intervals and/or greater levels of severity.
- **FCC3** represents high departure from the historic fire regime, resulting in high risk of resource loss due to frequent fire return intervals and/or high levels of severity. An example of FCC3 is an area that was formerly low-elevation sagebrush steppe that is currently dominated by an understory or

Table 12
Approximate Acreage of each Vegetation Type in the Monument and Percentage that occurs in each Fire Condition Class

VEGETATION TYPE	APPROXIMATE ACREAGE IN MONUMENT	% FCC1	% FCC2	% FCC3
Low-Elevation Sagebrush Steppe	157,000	40	20	40
Annual Grassland (exotic)	31,000	0	0	100
Perennial Grassland (seeding and native)	153,000	10	90	0
Mid-Elevation Sagebrush Steppe	9,400	0	100	0
Lava (bare and vegetated)	399,000	100	0	0
Mountain Shrub	400	50	50	0
Aspen	60	0	100	0
Conifer (Douglas fir)	140	50	50	0
Riparian	670	90	10	0

monoculture of cheatgrass.

Currently, several vegetation types within the Monument are in FCC2 or FCC3, with the exception of plant communities on lava (Table 12).

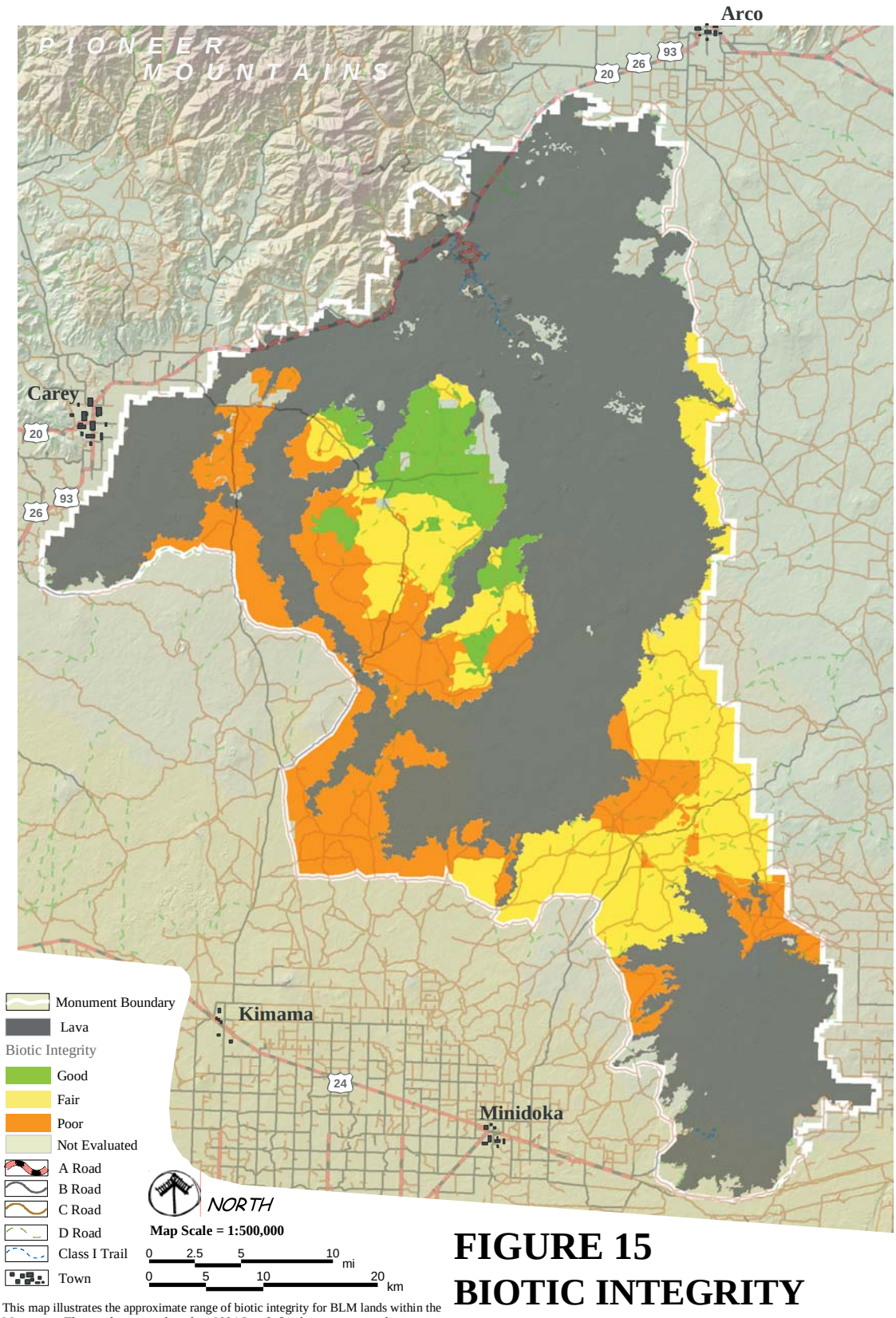
The Cohesive Strategy seeks to restore fire to its historic role in ecosystems through managing fire, fuels, and vegetation in order to return areas that are in FCC2 and FCC3 to the FCC1 class. It encourages proactive treatments to reduce fuels and restore plant community structure. These treatments can include prescribed fire, thinning, mowing, herbicides, seeding, temporary removal of livestock, and/or changes in grazing regimes. Current science and best available technologies and plant materials are considered in analysis and implementation of all fuels reduction and restoration projects. Recent inventories (Jurs and Sands 2004) categorized BLM-administered lands within the Monument according to their biotic integrity. In general, areas with poor biotic integrity are in FCC3, areas with fair biotic integrity are in FCC2, and areas with good biotic integrity are in FCC1 (see Figure 15).

Similar efforts may also follow unplanned wildland fires through emergency stabilization and rehabilitation (ESR) treatments, which can stabilize burned areas against erosion by wind or water, prevent the dominance of invasive or noxious weeds, and reestablish desirable perennial vegetation. ESR treatments are most commonly required on sites with highly erosive soils and areas in FCC3, and such treatments may be needed in areas in FCC2. The need for post-fire ESR is determined case by case, and Emergency Stabilization and Rehabilitation Plans are prepared in accordance with the Interagency Burned Area Emergency Stabilization and Rehabilitation Handbook, Department of the Interior Manual, and supplemental guidance by the BLM and NPS (http://fire.r9.fws.gov/ ifcc/Esr/Handbook/Default.htm).

Special Status Plants

The Monument also provides habitat for two state- and BLM-designated special status plants. Special status plants are those listed under the federal Endangered Species Act (ESA), plus species recognized by Idaho and BLM as sensitive. All species identified as sensitive by BLM must be managed proactively by BLM to protect these species, and NPS strives to manage its land to protect any federally listed, state-listed, or special status species.

The Idaho Native Plant Society (INPS) and Idaho Department of Fish and Game (IDFG) Conservation Data Center (ICDC) meet annually with state



This map illustrates the approximate range of biotic integrity for BLM lands within the Monument. These polygons are based on 2004 Jurs & Sands assessment and unpublished BLM data. No warranty is made by the Bureau of Land Management or National Park Service for use of the data for purposes not intended by these agencies.

FIGURE 15
BIOTIC INTEGRITY

Craters of the Moon National Monument & Preserve

U.S. Department of the Interior * National Park Service * Bureau of Land Management

and federal agencies to review the status of plants considered to be globally, state, or locally rare. The resulting list is used to determine which species, if they lack federal protection under ESA, require or would benefit from protection at a local or regional level.

Some of the plant communities in the Monument have undisturbed, relict, or pristine conditions or are excellent examples of a specific or even rare habitat type. The areas designated as Research Natural Areas (RNAs) are discussed later in this chapter.

There are no proposed or listed threatened or endangered plants known within the Monument. Potential habitat for Ute ladies' tresses (*Spiranthes diluvialis*), a federally listed threatened plant species, may exist throughout Idaho. Ute ladies' tresses, an orchid, occurs in moist to mesic sites associated with wetland and riparian areas, including springs,

Table 13
Vegetation Habitat Characteristics and Location Information for Special Status Plant Species Occurring in the Craters of the Moon National Monument and Preserve

NAME	HABITAT	LOCATION	SOILS	COMMUNITIES
Obscure phacelia (*Phacelia inconspicua*) (Murphy 2002b)	Northeast- to east-facing aspects on basaltic and rhyolitic buttes and foothills. Elevation ranges from 5,390 to 6,200 feet. Concave, lower to mid-slopes below the rimrock of butte tops or foothill ridgetops. Slopes are generally moderately steep (averaging about 32 percent), although some populations occur on nearly flat, sheltered terraces. The micro topography is often undulating due to numerous large boulders and stones deposited from the rimrock or ridges above. Phacelia grows in the depressions between boulders. Typically grows in small gaps (1 to 5 m^2) within shrubby vegetation in partially shaded microsites to full sunlight. Often grows on disturbed soil associated with older cattle trails, native ungulate trails, and gopher diggings. Subpopulations occupy transitional areas between mesic, dense vegetation dominated by *Populus tremuloides* (quaking aspen), *Prunus virginiana* (chokecherry), or *Lymus cinereus* (Great Basin wildrye), and open, xeric vegetation dominated by *Artemisia tridentata* ssp. *vaseyana* (mountain big sagebrush) with *Purshia tridentata* (bitterbrush), *Pseuoroegneria spicata* (bluebunch wheatgrass), and *Balsamorhiza sagittata* (arrowleaf balsamroot).	Eastern side of the Great Rift of the upper Snake River Plain and in the foothills of the Pioneer Mountains.	Dark-colored, well-drained silt-loams with varying amounts of sand, gravel, cobble, stone, and boulder colluvium intermixed. Most microsites are not cindery or extremely gravelly. Soils are derived from and overlay volcanic substrates. Areas supporting Phacelia usually lack litter accumulation, are always relatively loose or scarified (due to animal and erosion disturbance), and lack dense perennial vegetation. The soil depth varies from shallow (over boulders) to moderately deep.	*1) Prunus virginiana/Leymus cinereus* *2) Artemisia tridentata* ssp. *vaseyana-Symphoricarpos oreophilus (snowberry)/ Leymus cinereus* *3) Prunus virginiana-Symphoricarpos oreophilus* *4) Populus tremuloides/ Symphoricarpos oreophilus* *5) Prunus virginiana-Symphoricarpos oreophilus/ Pseudoroegneria spicata* *6) Artemisia tridentata* ssp. *vaseyana/Pseudoroegneria spicata*
Picabo milkvetch *(Astragalus oniciformis)* (Moseley and Popovich 1995; Alexander 2001)	Sandy basins, bowls, and flats within rolling basalt on the northern edge of the Snake River Plain. *A. oniciformis* is frequently found in open grassy areas (often in previously burned patches within *Artemisia* shrubland) and is rarely found in the understory of late seral *Artemisia* stands.	At the northern edge of the upper Snake River Plain and at the base of the foothills of the Pioneer Mountains and Picabo Hills.	Sandy loams or uniformly, highly calcareous silt loams overlying basalt plains. *A. oniciformis* prefers stabilized sandy soils and is never found on unstabilized sand dunes.	Primarily found in the *Artemisia tridentata* ssp. *wyomingensis* (Wyoming big sagebrush) / *Stipa comata* (needle-and-threadgrass) habitat type, but also *Artemisia tripartita/Pseudoroegneria spicata*. Common associates are *Oryzopsis hymenoides, A. tridentata* ssp. *tridentata*, and *Chrysothamnus* sp.

wet meadows, and river meanders. The plant is known to occur at sites ranging from 1,500 to 7,000 feet in elevation. This species generally flowers from mid-August through September in the Intermountain Region and can be identified definitively only at that time. Marginal, potential habitat for Ute ladies' tresses is limited to very small wet meadows associated with creeks and springs in the north part of the Monument.

Surveys for Ute ladies' tresses have been conducted in the past by ICDC botanists (Murphy 2002a) and were again performed in September 2002 by NPS and BLM botanists. No orchids were located as a result of these surveys. Although potential habitat is marginal, these areas will be revisited in the future, because the orchid can remain dormant for several years.

Two BLM sensitive plants are known to occur within the Monument. These species and their associated habitats are summarized in Table 13. Obscure phacelia (*Phacelia inconspicua*) is one of Idaho's most rare plants, with only six occurrences (population areas) known statewide. This species is also listed as endangered in Nevada. It occurs on north- and east-facing slopes of volcanic-based mountains and buttes. Picabo milkvetch (*Astragalus oniciformis*) is narrowly endemic to stable, sandy soils in the north-central portion of the ESRP, near the foothills of the Pioneer Mountains.

Areas within and surrounding the Monument have been systematically surveyed for both obscure phacelia and Picabo milkvetch, and population information is documented in status and monitoring reports (Moseley and Popovich 1995; Murphy 2002b). One location for meadow pussytoes (*Antennaria arcuata*), which is rare in Idaho but not a BLM sensitive species, has been documented directly outside of Monument boundaries in moist meadows associated with Huff Creek. There is a small amount of potential habitat at the northern edge of the Monument. Mourning milkvetch (*Astragalus atratus* var. *inseptus*), a BLM sensitive species, was recorded in a plant inventory of Brass Cap Kipuka RNA (Caicco and Wellner 1983b). However, a plant survey conducted by ICDC and BLM in the late 1980s did not confirm the occurrence of the milkvetch (Popovich 2003).

WATER RESOURCES, INCLUDING WETLANDS

Surface water resources are limited in the Monument. Stream channels are largely nonexistent within the exposed lava flows, and streams draining the Pioneer Mountains rapidly become subterranean once they encounter the lava flows. There are several small perennial streams in the Pioneer Mountains at the north end of the Monument. The entire watersheds of Little Cottonwood and Leech Creeks lie within the Monument. Very short segments of the Little Wood River, Big Cottonwood Creek, and Fish Creek fall just within the Monument boundaries.

The slopes of the Pioneer Mountains contain numerous perennial and ephemeral springs that feed small creeks and marsh wetlands. Just north of the Craters of the Moon Lava Field is a small hot springs complex. Parts of Lava Lake, Huff Lake, and Carey Lake Marsh also lie within Monument boundaries. Seasonal playa lakes are scattered throughout the sagebrush steppe desert. Many of these playas have been developed by BLM to create reservoirs, which increases their water holding capacity and longevity. Numerous caves within the Monument lava flows contain year-round ice deposits, which produce melt water during the summer.

Wetlands and Riparian Communities

Wetland and riparian communities are somewhat rare in the Monument. The cold-water springs, creeks, lakes, and marshes on the lower slopes of the Pioneer Mountains support limited aquatic, wetland, and riparian habitat for numerous plant and animal species. Several species of water-loving (hydrophilic) plants, waterfowl and marsh birds, two frog types, several small mammals, beaver, and moose use these habitats. Many other species use the water sources these areas provide.

Wetlands mapped by the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory

(NWI) are limited to the northwest corner of the Monument. Most wetlands and wetland habitat are palustrine (non-tidal, inland wetlands dominated by terrestrial and emergent vegetation) and are only seasonally or temporarily flooded.

The Monument is mostly composed of a semiarid sagebrush steppe ecosystem. These areas generally receive 8 to 14 inches of precipitation a year. With such little precipitation, snow runoff is the primary source of water for the few wetland areas in the Monument. The snow runoff accumulates in the flat-floored bottom of an undrained desert basin that sometimes becomes shallow lakes called playas. They hold water long enough to allow some specialized aquatic organisms to grow and reproduce, but not long enough for a pond or marsh ecosystem to develop because most of the playas dry up by July and August.

Fairy shrimp, a scarce freshwater crustacean, can be found in almost every seasonal pool (Bratton 1990). Fairy shrimp serve as a valuable food source for migratory waterfowl that use the playas as resting areas along their long trek north in spring and early summer.

Water Quality

Steep-sided canyons with high gradient channels and a narrow floodplain characterize the watershed of Little Cottonwood and Leech Creeks. Mean discharge rates for both streams are less than 1 cubic foot per second. Since the 1930s, NPS has diverted water from four springs in the upper Little Cottonwood Creek Watershed for a public drinking water supply. During dry years, these diversions accelerate the dewatering of stream channels throughout the middle and lower reaches of Little Cottonwood Creek. However, the lower reach of Leech Creek has also run dry with no diversions in place.

To meet new drinking water standards, efforts were initiated in 2000 to replace the existing surface drinking water sources with groundwater sources. Shallow water wells have been developed at the bottom of Leech and Little Cottonwood drainages. Surface water from the two streams disappears below the surface in this vicinity even during wet years. Once the wells are fully operational in 2004, upstream diversions will cease.

Mining activities in the Little Cottonwood Creek drainage predate the establishment of the Monument in the 1920s. Open adits and tailings material remained along the stream until an NPS reclamation project was completed in the mid-1990s. Before this reclamation work, copper and zinc concentrations had exceeded U.S. Environmental Protection Agency (EPA) water quality criteria (USDI NPS 1998).

Streamwater quality in Little Cottonwood and Leech creeks has been monitored and has generally been found to be good, with no violations of Idaho State standards for temperature, dissolved oxygen, and turbidity (Falter and Freitag 1996). Total dissolved solids content of the water, as indicated by electrical conductivity, has been found to be moderate to low. The stream's waters are carbonate-based, of moderately low alkalinity and carbon dioxide, and neutral to slightly basic pH. Streamwater nutrient concentrations of total phosphorus have been shown to be moderately high with nitrogen limitation indicated, and streamwater concentrations of nitrate nitrogen are high.

Low to moderate levels of fecal coliform with high fecal streptococcus bacteria in streams suggest animal, rather than human, influence on the stream. Aquatic insect associations are balanced, with the exception of the middle reach of Little Cottonwood Creek, where Dipteran (true flies) dominance suggests metals impact from the Martin Mine site (Falter 1996). Stream bank and channel stability is good, with little indication of eroding or collapsing banks.

Ice caves easily accessible to the public have been found to have much higher levels of nutrients than caves located in remote areas. This may be attributable to human waste (Falter and Freitag 1996).

Water Rights/Water Use

The State of Idaho granted NPS federal reserved

water rights within the Monument in 1998. The priority dates of the rights range from 1924 to 1996, depending on the date when each area was added to the Monument. These rights grant diversions of 54.5-acre feet per year from all surface water and groundwater sources within the 1998 Monument boundaries. The rights provide for domestic, irrigation, or industrial use within the Monument, as well as in-streamflow rights on areas including Little Cottonwood and Leech Creeks (Hurlbutt 1998). The rights do not entitle the United States to maintain any specific water table elevation in the Snake River Aquifer beneath the Monument.

The BLM has 337 filed water right claims on 18 springs, 192 playa lakes, and 127 reservoirs within the Monument. The claims, primarily used for stock water and wildlife, are for 333.5 total acre-feet per year, and a de minimus amount of 0.02 cubic feet per second on each source. Priority dates of the water rights claims are as early as 1926.

Many of the water resources in the Monument are used in a variety of ways: drinking water for the Monument Visitor Center, irrigation water for farms, livestock watering sites, and recreational opportunities like bird watching. Human use and activities sometimes alter water and associated resources. Playas and reservoirs developed by BLM are an integral part of this semiarid ecosystem, and they often are the only source of water for wildlife and livestock.

The aquatic and wetland habitat supported by the only thermal spring complex in the Monument has historically been altered by concentrated livestock use and human recreation. Efforts are underway to protect the unique Monument habitat and allow recovery of the biological resources present.

WILDLIFE, INCLUDING SPECIAL STATUS SPECIES

During some portion of each year, about 200 species of birds, 60 mammals, 10 reptiles, and at least three amphibians occupy the Monument (see Appendices D and E). Surveys in the late 1960s in a very small portion of the northernmost area identified more than 2,000 species of insects (Horning and Barr 1970).

Wildlife Habitats and Common Monument Wildlife

Sagebrush steppe communities comprise much of the wildlife habitat within the Monument. Numerous species are found in sagebrush habitats (Braun et al. 1976, Trimbel 1989). Some of these are sagebrush obligates (restricted to sagebrush habitats during the breeding season or year-round) or near obligates (occurring in both sagebrush and grassland habitats; Paige and Ritter 1999).

Sagebrush obligates that occur in the Monument include the sage sparrow, black-throated sparrow, Brewer's sparrow, sage thrasher, greater sage-grouse, pygmy rabbit, sagebrush vole, and sagebrush lizard. Some species, such as Brewer's sparrows, are at their highest densities statewide in ungrazed portions of the Monument (Bart 2001). Table 14 lists some sagebrush-associated species that can be found in the Monument.

Sagebrush itself and the native perennial grasses and forbs of the shrub-steppe are important sources of food and cover for wildlife (Dealy et al. 1981). During winter, the evergreen foliage of sagebrush often provides the only available green vegetation, and its protein level and digestibility are higher than that of most other shrubs and grasses (Peterson 1995). Pronghorn, pygmy rabbits, and sage-grouse may eat exclusively sagebrush in winter, and sagebrush also becomes a major portion of mule deer and elk diets. Taller sagebrush provides cover for mule deer and sage-grouse (Dealy et al. 1981), and the crowns of sagebrush break up hard-packed snow, making it easier for animals to forage on the grasses beneath (Peterson 1995).

Throughout the rest of the year, sagebrush provides food for pygmy rabbits and sage-grouse; protective cover for fawns, calves, rabbits, and grouse broods; and nesting sites for many shrub-nesting birds. The sage thrasher, Brewer's sparrow, sage sparrow, and greater sage-grouse most frequently nest in or beneath sagebrush.

The Monument contains portions of the lower

Table 14
Sagebrush-Associated Species that Occur in the Monument

BIRDS		
Chukar	Grasshopper sparrow	Sage sparrow
Black-throated sparrow	Golden eagle	Short-eared owl
Burrowing owl	Great horned owl	Ferruginous hawk
Red-tailed hawk	Swainson's hawk	Rough-legged hawk
Turkey vulture	Greater sage-grouse	Lark sparrow
Common nighthawk	Northern harrier	Common raven
American crow	Bobolink	Gray flycatcher
Horned lark	Brewer's blackbird	Gyr falcon
Peregrine falcon	Prairie falcon	American kestrel
Loggerhead shrike	Brown-headed cowbird	Ash-throated flycatcher
Long-billed curlew	Sage thrasher	Savannah sparrow
Lazuli bunting	Gray partridge	Common poorwill
Ring-necked pheasant	Green-tailed towhee	Spotted towhee
Vesper sparrow	Say's phoebe	Brewer's sparrow
Western meadowlark	Mourning dove	White-crowned sparrow
MAMMALS		
Pronghorn	Pygmy rabbit	Coyote
Elk	Ord's kangaroo rat	Bobcat
Sagebrush vole	Black-tailed jackrabbit	White-tailed jackrabbit
Yellow-bellied marmot	Montane vole	Long-tailed vole
Mule deer	Northern grasshopper mouse	Great Basin pocket mouse
Deer mouse	Raccoon	Merriam's shrew
Piute ground squirrel	Nutall's cottontail	Least chipmunk
Badger	Northern pocket gopher	Red fox
Kit fox	Yuma bat	Long-eared bat
Long-legged bat	Small-footed myotis	Fringed myotis
Townsend's big-eared bat	Spotted bat	
REPTILES & AMPHIBIANS		
Rubber boa	Western yellow-bellied racer	Western rattlesnake
Western skink	Long-nosed leopard lizard	Night snake
Short-horned lizard	Desert horned lizard	Gopher snake
Sagebrush lizard	Western terrestrial garter snake	Great Basin spadefoot toad

slopes of the Pioneer Mountains, which contain both perennial and ephemeral springs. Several of these springs feed small creeks and marshes, and several species of waterfowl and marsh birds, two frog species, several small mammals, beaver, and moose use these habitats exclusively, along with several other species. Numerous species of birds use these areas exclusively or as primary habitat in the area.

The Monument contains some scattered stands of trees, including riparian stands of black cottonwood, willows, alders, and quaking aspen; upland stands of quaking aspen or Douglas fir; and lava- or cinder-based stands of limber pine and junipers. These forested sites are used by more than 110 species of birds, at least four species of reptiles, and at least 37 mammals (USDI NPS 2003). These coniferous stands are widely scattered throughout the Monument. The open shrub-steppe and agricultural lands of the Snake River Basin surround these small islands of trees.

Migrant forest birds are highly selective of resting habitat (Kerlinger 1995), and these forest stands are important to forest birds migrating from the Northern Rocky Mountains, needing to cross the open habitat of the basin. Dozens of species of migratory birds use the conifer stands. Many resident species, including Clark's nutcracker, chickadees, nuthatches, woodpeckers, and others, use them exclusively. Forested sites also provide critical thermal cover for deer, elk, and moose in the foothills of the Pioneer Mountains (Griffith 1983).

Extensive lava flows also serve as habitat for numerous animal species. At least seven species of bats, several species of rodents, and several species of cave invertebrates use lava tubes and flows in the Monument. The flow surfaces also are used by many species of vertebrates and invertebrates, and several species are dependent on the lava structures. Species such as pika, woodrats, skinks, and rock wrens are found primarily on the rock surfaces. Several snake and bat species are dependent on cavities in the lava for hibernation sites. Two of the three known bat maternity colonies of Townsend's big-eared bat in Idaho are in the Monument (Pierson et al. 1999).

Subspecies of the Great Basin pocket mouse, the pika, and the yellow-pine chipmunk are endemic to the lavas of the Great Rift. Darker fur characterizes these subspecies, which may be an adaptation to the black lava rock. Known primarily as residents of high-elevation alpine regions, pikas living on the Craters of the Moon Lava Field occupy lower elevations and the highest mean temperatures within the species, range (Bever 2002).

Several species of birds are also dependent on the lava structures. The Monument has a large population of rock wrens that nest almost exclusively on basalt formations. Many cavity-nesting species nest in rock cavities on the flows. Chickadees and swallows are typically associated with woodlands but will use rock crevices when near limber pine or juniper stands. Mountain bluebirds and violet-green swallows nest primarily in tree cavities but are known to use rock crevices for nesting. Both species have been documented nesting in crevices and bubbles in flow surfaces in the Monument (Rich 1985; USDI NPS 2003).

Both western and mountain bluebirds have experienced major range-wide declines as result of habitat loss and competition from introduced European starlings. Bluebirds nest in high densities in the northern part of the Monument but are seen far less frequently in the southern areas, where substantial flocks of starlings now breed.

Fox

Numerous bird species protected under the Migratory Bird Treaty Act (USC Title 16, Chapter 7, Subchapter II; Appendix E) have been documented in the Monument, occupying all habitat types. The migrant patterns include permanent residents, summer residents, migrants only using resting areas a few days a year, and winter-only residents.

Reptiles in the Monument also occupy a wide range of habitats. Ten species of reptiles have been identified in the Monument, including five snakes and five lizards. Several hibernating sites for snakes have been identified in the Monument (Lee 2002). These hibernacula may contain animals from several square miles of summer habitat both inside and outside the Monument. Garter snakes and rubber boas are predominantly riparian species, and skinks and gopher snakes use primarily rocky habitats with sparse vegetation. Night snakes may occupy the area but are rare and difficult to survey (Peterson 2003).

Two frog species occur in the Monument, Boreal chorus frog and Pacific tree frog. Two toad species may exist in the Monument as well. One, the Great Basin spadefoot toad, has not been detected in recent inventory work, but it can remain dormant for several years and is not readily detected while in burrows. These toads are well documented in the Snake River Plain, and it is likely that they occupy the Monument as well. Western toads have not been detected in surveys since 1987; they may have been extirpated.

Six species of large mammals are known to inhabit the Monument: mule deer, pronghorn, elk, cougar, black bear, and moose. Most are widespread throughout the Snake River Plain, and Pioneer Mountains and regularly can be found in the Monument.

Mule deer occupy the northern parts of the area as spring and summer range, with two distinct herds migrating into the Pioneer Mountains by autumn (Griffith 1983). One of these herds comes from lands to the north and west of the Monument. The other herd winters in the desert area south of the Craters of the Moon Lava Field. This herd slowly migrates to the northwest as vegetation dries out throughout the summer. By late summer or early fall this herd has merged with the herd from the northwest. Upon reaching the riparian areas, they have access to water and browse that is still fresh.

Mule deer are scattered throughout the most of the vegetated areas. Few studies have been conducted outside of the northwest portion (Griffith 1983). NPS monitoring since 1988 in the northwest part of the Monument indicates a very dynamic population that fluctuates greatly with varying annual conditions. This may even include shifting migration routes out of the area in some years (IDFG 2003). The south part of the Monument contains substantial winter range for deer and pronghorn (IDFG 2003). Since 1999, moose have been regularly seen in both the Big and Little Cottonwood Creek watersheds of the Pioneer Mountains.

Elk summer in the riparian areas of the northwest part of the Monument (USDI NPS 2003). Elk occupy widely scattered areas, with records from both immediately east and west of the Craters of the Moon Lava Field and in larger kipukas like Laidlaw Park. Larger numbers of elk winter in the Pioneer Mountains along the northwestern part of the Monument. Two distinct groups of more than of 100 animals each were recorded moving back and forth across the west boundary during early 2003 (IDFG

Mule deer

2003). In summer, most of these elk move to summer range west and north of the Monument, with only a few animals remaining in the Monument.

Pronghorn are found within much of the Monument and are common throughout the year in Laidlaw Park (IDFG 2003; USDI NPS 2003). A migratory herd of pronghorn uses the western part of the Monument as a migratory corridor and birthing area (IDFG 2003; USDI NPS 2003). Occasional use during winter has also been recorded in this area (USDI NPS 2003). Smaller numbers of animals can be found along the east boundary and in the rift crack area. Winter range has been identified in the southern areas and the rift crack area (IDFG 2003).

Both cougar and black bear are found in the Pioneer Mountains area of the Monument. In recent decades, documented observations have been confined to the northern part of the Monument in or adjacent to the Pioneer Mountains. Sightings of these two species are rare, and little is known about their status in the Monument.

Moose colonized the riparian areas of the Monument in 1999 and continue to be present. Suitable habitat is limited in the Monument, so that further expansion is not likely.

Four species of large mammals and one small mammal were extirpated from the Monument during the twentieth century. The North American bison, bighorn sheep, wolf, and grizzly bear were last documented in the early twentieth century (Smithsonian Institution 2003). Some wolves from the reintroduced Central Idaho packs occupy territory immediately north of the area. One previously extirpated species, the porcupine, has recently reoccupied historic habitat within the Monument (USDI NPS 2003).

Pest Control – Grasshoppers

The BLM currently implements an integrated grasshopper/Mormon cricket control program in cooperation with the U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS). Extreme grasshopper population increases can occur during years favorable to their survival. High numbers of grasshoppers have caused and will continue to cause damage to agricultural crops adjacent to public lands.

There are areas of the Monument adjacent to agricultural crops. One is the private land that borders the Monument south and east of Carey, another is the private land that borders the Monument east of the Wapi Lava Flow, and a third is located along the northeast tip of the Monument near Arco. These agricultural cropland interface areas potentially could be grasshopper treatment areas. These cropland interface areas have traditionally grown crops such as potatoes, beets, corn, barley, alfalfa, and beans, which may be fertilized and treated with pesticides and herbicides.

The USDA, APHIS, and BLM have worked together since the 1960s to control grasshoppers and Mormon crickets on public lands. In 1985, the Secretary of Agriculture issued Instruction Memorandum No. ID-85-242, approving application for applying pesticides by APHIS on more than 6.4 million acres of BLM-managed public land to control grasshoppers. That year, the southern one-fourth to one-third of what is now the Monument was aerially sprayed with malathion to control grasshoppers.

In 1986, APHIS and BLM conducted the Nosema Locustae Project along the Little Wood River northeast of Richfield, which is now part of the Monument. Nosema is a biological control agent that affects the grasshoppers' reproductive organs. It was aerially applied to 10,279 BLM acres, 956 state acres, and 673 private acres.

The state directors have issued Final Decisions for the Environmental Assessments (EA) completed for Site-Specific Environmental Assessment Rangeland Grasshopper Suppression Program (USDA 2004) and Site-Specific Environmental Assessment Rangeland Mormon Cricket Suppression Program (USDA 2004) These final decisions have a concise version of APHIS and BLM standard operating procedures and application guidelines. The USDA and APHIS are working on new BLM policy that allows some control of insect outbreaks in WSAs and Areas of

Critical Environmental Concern (ACECs) as related in Washington Office Instruction Memorandum No. 87-408.

NPS policies address the management of native species, such as grasshoppers, which may become pests. Chapter 4 of the NPS Management Policies (USDI NPS 2001) addresses Management of Native Plants and Animals (4.4.2.1) and Pest Management (4.4.5), including the use of pesticides. According to NPS policy, native pests will be allowed to function unimpeded, except that native pests may be controlled to:

- Conserve threatened, rare, or endangered species or unique specimens or communities;
- Preserve, maintain, or restore the historical integrity of cultural resources;
- Conserve and protect plants, animals, and facilities in developed areas;
- Prevent outbreaks of a pest from invading uninfested areas outside the Monument; or
- Manage a human health hazard when advised to do so by the U.S. Public Health Program, or to otherwise protect against a significant threat to human safety.

The NPS follows an integrated pest management process to address all pest issues on a case-by-case basis. Controversial issues, or those with potential to negatively impact the environment, must be assessed according to the National Environmental Policy Act (NEPA). Intervention to control pests may not be undertaken if the pest control actions would cause unacceptable impacts on the populations of other species or other components and process of the ecosystem that support them.

Wildlife Damage Control

The Wildlife Services (WS) branch of USDA APHIS is authorized by the U.S. Congress to protect American resources and human health and safety from damage associated with wildlife (Animal Damage Control Act of March 2, 1931, as amended [46 Stat. 1486: 7 USC 426-426c] and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988 [PL 100-102, Dec. 27, 1987; Stat. 1329-1331 7 USC 426C]). A 1995 Memorandum of Understanding (MOU) between APHIS WS and BLM is the basis for an annual APHIS WS plan covering those APHIS WS wildlife damage control activities on public (BLM) lands within BLM's Twin Falls District.

APHIS WS conducts wildlife damage control activities in response to requests for assistance, when and where there is a demonstrated need, and after review of the available evidence. Assistance includes providing technical assistance and direct control by APHIS WS wildlife damage specialists. Direct control includes the use of traps, snares and other devices, as well as aerial gunning (shooting animals from aircraft). Most animal damage control activities in the Monument have been directed at controlling coyote depredation on sheep.

The state authorizes animal damage activities on BLM-administered land; therefore, wildlife damage control will continue to be implemented during the planning process. For BLM-administered land, wildlife damage control, including any necessary preemptive strategies, will continue to be governed by applicable laws. The BLM will continue to coordinate with Wildlife Services as described in existing national MOUs, BLM state policy, and Twin Falls District annual meetings with APHIS WS. Aerial gunning over WSAs requires approval of the BLM State Director.

Within the original Monument and Preserve, NPS management policy limits the management of native animals to specific circumstances, including unnaturally high populations resulting from human influences or to protect property. The NPS Superintendent has the authority to authorize removal of native pest animals (animals that interfere with the purposes or management objectives of a specific area or that jeopardize human health) on NPS-administered land when needed to:

- Conserve threatened, rare, or endangered species or unique specimens or communities;
- Preserve, maintain, or restore the historical integrity of cultural resources;

- Conserve and protect plants, animals, and facilities in developed areas;
- Prevent outbreaks of a pest from invading uninfested areas outside the NPS lands; or
- Manage a human health hazard.

Nothing in this section should be construed as authorizing Wildlife Services or any other entity to take a species formally listed under the Endangered Species Act. For example, although the gray wolf is currently classified as experimental/nonessential throughout Idaho south of Interstate 90, Section 10 of the ESA specifies that such populations should be treated as threatened species on NPS-administered lands. The entire Monument, both NPS- and BLM-administered lands, will be treated as if it were an NPS unit for the purposes of ESA Section 10.

NPS actions to remove or control native pests require appropriate compliance with NEPA.

Special Status Animals

Special status species are those listed as endangered or threatened under the ESA; candidates or species proposed for listing under the ESA; species listed by IDFG as endangered, threatened, or species of special concern; and/or species listed by BLM as sensitive. The BLM manages all species identified as sensitive to minimize the need for future listing as threatened or endangered under the ESA. NPS strives to manage its lands to protect any federally listed, state-listed, or BLM listed species.

The USFWS has provided a list of endangered, threatened, proposed, and/or candidate species that may be present in the area of the Monument (Table 15). According to this list, threatened and endangered animal species that could potentially occur in the Monument area are Canada lynx (*Lynx canadensis*), gray wolf (*Canis lupus*), bald eagle (*Haliaeetus leucocephalus*), bull trout (*Salvelinus confluentus*), Bliss Rapids snail (*Taylorconcha serpenticola*), Utah valvata snail (*Valvata utahensis*), and Snake River physa (*Physa natricina*). However, sufficient habitat for Canada lynx, bull trout, and the snails is not available. The Monument area is not in a Lynx Analysis Unit because it lacks suitable habitat for the species. There is not adequate surface water present in the Monument area for the survival of bull trout or the snails, all of which require substantial riverine habitat.

Gray wolves are known to occur in the vicinity of the Monument (Williams 2002). In the spring and winter of 2001, a pack was observed and tracked just north of the Monument. The pack was thought to have followed migrating elk and deer. In addition, individual wolves have been observed near the boundary of the Monument, with several confirmed sightings in this area since 2000.

There is a bald eagle breeding territory just west of the Monument near Carey Lake. Transient, wintering bald eagles might be found anywhere throughout Blaine, Butte, Minidoka, and Power Counties, including parts of the Monument.

Greater sage-grouse (*Centrocercus urophasianus*) has been petitioned for federal listing and is a BLM sensitive species. Since 1950, 148 sage-grouse leks have been documented on BLM-administered land within the Monument. Between 1979 and 1983, 83 leks were active, and between 1999 and 2003, there were 53 active leks. These observations (made by the Idaho Department of Fish and Game) indicate a 36 percent decrease in sage-grouse leks over the past 25 years.

Three sub-units of the Monument were also analyzed both for total number of leks and possible influence of wildfire. The results are presented below in Table 16. Note that these sub-units do not represent the entire Monument.

The percent change in number of leks between burned and unburned areas is relatively similar, except in southern Laidlaw Park where cheatgrass (*Bromus tectorum*) has become dominant. In that particular area, seven leks were lost, while one new lek was established. In all cases, current active leks are within 2 miles of an unburned area suitable for nesting and early brood rearing.

Table 15
Special Status Animal Species in the Monument

SPECIES	STATUS		
	FEDERAL	BLM	IDAHO
MAMMALS			
Gray wolf (*Canis lupus*)	T		
Townsends's big-eared bat (*Corynorhinus townsendii*)	I	S	S
Western small-footed myotis (*Myotis ciliolabrum*)	I	W	
Long-eared myotis (*Myotis evotis*)		W	
Fringed myotis (*Myotis thysanodes*)		S	S
Long-legged myotis (*Myotis volans*)	I	W	
Yuma myotis (*Myotis yumanensis*)	I	W	
Western pipistrelle (*Pipstrellus hesperus*)	I	W	S
Pygmy rabbit (*Brachylagus idahoensis*)	I	S	S
Kit fox (*Vulpes macrotis*)	I	S	
Piute ground squirrel (*Spermophilis mollis*)		S	
BIRDS			
White-faced Ibis (*Plegadis chihi*)	I	S	
Bald eagle (*Haliaeetus leucocephalus*)	T		
Northern goshawk (*Accipiter gentilis*)	I	S	S
Ferruginous hawk (*Buteo regalis*)	I	S	
Swainson's hawk (*Buteo swainsoni*)		W	
Prairie falcon (*Falco mexicanus*)		S	
Peregrine falcon (*Falco peregrinus*)			E
Blue grouse (*Dendrogapus obscurus)*		W	
Greater Sage-grouse (*Centrocercus urophasianus*)	I	S	
Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*)	I	S	S
Wilsons's phalarope (*Phalaropus bicolor*)		W	
Long-billed curlew (*Numenius americanus*)	I	W	
Black tern (*Chlidonias niger*)			S
Short-eared owl (*Asio flammeus*)		W	
Western burrowing owl (*Athene cunicularia*)	I	W	S
Calliope hummingbird (*Stellula calliope*)		S	
Lewis' woodpecker (*Melanerpes lewis*)		S	
Red-naped sapsucker (*Sphyrapicus nuchalis*)		W	
Williamson's sapsucker (*Sphyrapicus thryoideus*)		S	
Olive-sided flycatcher (*Contopus borealis*)		S	
Loggerhead shrike (*Lanias ludovicianus*)	I	S	SA
Cordilleran flycatcher (*Empidonax occidentalis*)		W	
Hammond's flycatcher (*Empidonax hammondii*)		S	
Willow flycatcher (*Empidonax traillii*)		S	
Pinyon jay (*Gymnorhinus cyanocephalus*)		W	
Sage thrasher (*Oreoscoptes montanus)*		W	
Green-tailed towhee (*Pipilo chlorurus*)		W	
Grasshopper sparrow (*Ammodramus savannarum*)		W	
Brewer's sparrow (*Spizella breweri*)		S	
Sage sparrow (*Amphispiza belli*)		S	
Black-throated sparrow (*Amphispiza bilincata*)		S	
Brewer's blackbird (*Euphagus cyanocephalus*)		W	
Cassin's finch (*Carposdacus cassinii*)		W	

Table 15, Continued
Special Status Animal Species in the Monument

SPECIES	STATUS		
	FEDERAL	BLM	IDAHO
REPTILES & AMPHIBIANS			
Western night snake (*Hypsiglena torquata*)		S	
Western toad (*Bufo boreas*)	I	S	S
Short-horned lizard (*Phrynosoma douglassi*)	I		
INVERTEBRATES			
Idaho dunes tiger beetle (*Cicindela arenicola*)	I	S	
Blind cave leiodid beetle (*Glacicavicola bathysciodes*)	I	S	
Idaho pointheaded grasshopper (*Arolophitus pulchellus*)	I	S	

Federal Designations:
E = Federally Endangered
T = Federally Threatened
C = Federal Candidates for listing as T or E
I = Species of concern to USF&WS but without formal federal status

BLM
S = Bureau of Land Management Sensitive Species: in this listing, all species without other current status but formerly federal candidates or state species of concern; additionally all species with either federal or state status should also be considered BLM Sensitive Species.
W = Watch list species: Species that are not BLM sensitive species but current population or habitat information suggests that the species may warrant sensitive species status in the future

Idaho Species of Special Concern: (Native species that are either low in numbers, limited in distribution, or have suffered significant habitat losses)
E = Endangered, S = Special concern

Three conclusions may be drawn from these and related observations:

- Sage-grouse show a high affinity for lek sites, even after they are burned, if cheatgrass does not become dominant (this hypothesis deserves further study).
- The overall downward trend in the number of sage-grouse leks is not due entirely to wildfire. The major land use affecting sage-grouse habitat is historic livestock grazing.

The concurrent decline in the health of native plant communities, as indicated by Rangeland Health Standards and Guidelines assessments, points to livestock grazing as a major contributing factor in the decline of sage-grouse populations within the Monument. Decreased cover by native perennial grasses and forbs (relative to the appropriate range site descriptions) is likely responsible for decreased sage-grouse production as indicated by the decrease in number of leks.

Table 16
Active Sage-Grouse Leks

AREA	1979-1983	1999-2003	COMMENT
Paddelford Flat	8	9 (+12%)	1 lek lost on private land and 2 new leks in burred and seeded area.
Little Park	9	6 (-33%)	No leks impacted by fire.
Laidlaw Park	47	23 (-51%)	In areas that burned during the 20-year period, there were 18 leks in 1979-83 and 8 leks in 1999-2003.

- Regardless of the initial cause (fire, livestock, or some other vector), the dominance of cheatgrass significantly degrades the quality of sage-grouse habitat.

Additionally, the BLM and IDFG have classified sage-grouse habitat in southern Idaho into four groups: Key, Restoration 1 (R1), Restoration 2 (R2), and Restoration 3 (R3).

- Key habitat areas are generally large-scale, intact sagebrush steppe areas that provide sage-grouse habitat.
- R1 lands are sagebrush limited areas with acceptable understory conditions in terms of grass species composition.
- R2 lands are areas with existing sagebrush cover that may or may not be adequate to meet the needs of sage-grouse, but the understory herbaceous conditions are poor.
- R3 lands are areas where junipers are encroaching into sage-grouse habitat.

Within the Monument, there are approximately 340,000 acres of sage-grouse habitat, of which 65 percent is Key habitat, 25 percent is R1 habitat, and 10 percent is R2 habitat.

IDFG has also identified some areas as stronghold or source habitat. These are generally the most important remnants of sage-grouse habitat and have the potential to produce birds that could then populate non-stronghold areas. In the Monument, 43 percent of the sage-grouse habitat is classified as stronghold.

Pygmy rabbits have been documented in several areas of the Monument. Records ranging from the 1930s through 2003 indicate locations from the southernmost areas to the original Monument lands (Hoffman 1988; USDI NPS 2003). Pygmy rabbit populations have experienced severe declines throughout their range, including in Idaho. The rabbits generally prefer mature sagebrush stands with a dense canopy cover (Gabler et al. 2001). However, there are few surveys for the species in southern Idaho, and the distribution and status of the species is not well understood.

The Monument contains hundreds of caves and several cave-related species of concern, including seven species of bats that are USFWS species of concern, Idaho species of special concern, or BLM sensitive species. As of 1999, three maternity colonies of Townsend's big-eared bat (*Corynorhinus townsendii*) have been identified in Idaho (Pierson et al. 1999), with two occurring in the Monument. Numerous hibernacula have been identified in the Monument for this and other bat species. Six other cave roosting bats that are classified as sensitive or of concern are found in the Monument (Table 15; Keller 1996). In addition to bats, other cave species are of concern, including the blind cave leiodid beetle (*Glavcicavicola bathyscioides*). Two of the four known worldwide sites for this species are in the Monument (ICDC 2002a).

Two additional insects listed as sensitive by BLM and as USFWS species of concern have been documented on lands adjacent to the Monument. One, the Idaho point-headed grasshopper (*Acrolophitus pulchellus*), is found in the Lost River drainage adjacent to the Monument. Two of the five known sites are near the northeast perimeter of the Monument (ICDC 2002b). The preferred habitat is relatively level or rolling terrain with gravelly to rocky soil having low sparse vegetative cover between 4,800 and 7,000 feet elevation (ICDC 2002b).

The Idaho dunes tiger beetle (*Cicindela arenicota*) is found only in sand dunes in south central and southeast Idaho. Beetles have been documented at several sites near the southeast corner of the Wapi Lava Field (Idaho State Conservation Effort 1996). More potential habitat for this beetle may exist with the Monument.

Table 15 lists the special status animal species that are known or reported in the Monument, including all those mentioned above. In addition, the table lists 42 sensitive species that are either migratory birds or sagebrush related species that have been discussed in this section. Table 15 is a representation of a dynamic list that is expected to change over the life of the plan. The most current list will always be the applicable special status species list.

AIR QUALITY

The Monument and Preserve lie within one of the cleanest air regions of the country. While generally below the national average for most pollutants, the area's relative ranking varies, depending on the specific pollutant. Air quality also varies, depending on the location within the unit, the pollutant being measured, the season and time of day, wind direction, and climatic factors. Clean air enhances the understanding and appreciation of the Monument's geologic resources by allowing clear views of distant landscape features.

Sources of air pollutants are both local and regional (Table 17). Emission sources within the Monument are limited to automobile exhaust, smoke from wood stoves and campfires, smoke from wildfires, and windblown dust. Smoke from forest and rangeland fires, as well as agricultural burning, are seasonal sources of fine particulate matter, carbon monoxide, and volatile organic compounds. Industrial point sources are located at the Idaho National Engineering and Environmental Laboratory (INEEL), which is 12 miles east of the Monument, and Bonneville, Bingham, and Bannock Counties to the east. Population densities in the four counties surrounding the Monument range from 1.3 to 26.6 people per square mile, with a total population of 50,000 people across 7,043 square miles (Idaho Department of Commerce 2000).

The air quality management of fire and roads is the primary activity affecting resources in the Monument. Both naturally ignited wildland fires and prescribed fires produce smoke emissions over the life of the fire. The amount of smoke produced and the rate at which it disperses will vary, depending on weather conditions existing during the fire, the amount and type of vegetation burned, and the moisture content of the vegetation consumed. As actively managed events, prescribed fires burn at a controlled size, intensity, and time; therefore, smoke emissions can be minimized and dispersal rates maximized. While wildland fires result from natural, unplanned ignitions, decisions to manage the fire for resource benefits or extinguish it are based in part on the potential impacts of the smoke generated over the life of the fire.

The major pollutant of concern in smoke from fire is fine particulate matter (PM), both PM10 and PM2.5. National Ambient Air Quality Standards (NAAQS) for PM are established for two aerodynamic diam-

Table 17
Regional Point Sources of Criteria Air Pollutants in Tons per Year

SOURCE	COUNTY (IDAHO)	CARBON DIOXIDE	NITROGEN OXIDES	PM2.5	PM10	SULFUR DIOXIDE	VOLATILE ORGANIC COMPOUNDS
Amalgamated Sugar	Minidoka	131	431	214	630	511	1.76
FMC	Power	2	9	1,391	1,657	2,935	0
JR Simplot	Bannock	11	1,011	244	307	7,133	0
Ash Grove Cement	Bannock	0	124	184	288	488	0
Idaho Supreme Potato	Bingham	2	64	70	243	67	0
INEEL-DOE	Butte	8	518	3	5	657	0

Source: U.S. Environmental Protection Agency, National Emissions Trend Database 1999, via http://scorecard.org/index.tcl

eter classes: PM10 is particulate matter less than 10 microns in diameter, and PM2.5 is less than 2.5 microns in diameter. Studies indicate that 90 percent of all smoke particles emitted during wildland burning is PM10, and 90 percent of PM10 is PM2.5 (Ward et al. 1991). In 2001, the PM2.5 annual average within the Monument was 2.8 micrograms per cubic meter (µg/m3; Visibility Information Exchange Web System: http://vista.cira. colostate. edu/views/Default.htm), compared with the national health-based standard of 15 µg/m3.

Fugitive dust consists of PM suspended in the air by the wind and human activities. It originates primarily from the soil and is not emitted from vents, chimneys, or stacks. Soils on burned lands or bare agricultural lands lacking vegetative cover are subject to wind erosion of soil particles until vegetative cover is restored. Fugitive dust can also be generated by wind blowing across unpaved roadbeds and by the passage of vehicles along the same roads.

Estimates of the quantity of fugitive dust generated are imprecise and difficult to calculate. The amount of dust produced and its effects vary seasonally with weather conditions (soil moisture, wind speed, and direction) and the amount and speed of motor vehicle traffic. The best indicator of fugitive dust potential is fugitive dust sources, including unpaved roads and lands burned to remove vegetative cover.

The Craters of the Moon National Wilderness Area ("43,243" acres) within the Monument is a mandatory Class I area, as defined in Clean Air Act (42 USC Sections 7401-7671q; as amended in 1990, PL 101-549). Congress created a Prevention of Significant Deterioration (PSD) section, the purpose of which is "to preserve, protect, and enhance the air quality in national parks, national wilderness areas and other areas of special national or regional natural, recreational, scenic, or historic value." Specifically, the PSD section reflected the law's intention that, among the clean air regions of the country, certain areas – the Class I areas – deserve the highest level of air quality protection. The impairment of visibility within Class I areas was a major concern addressed in the Clean Air Act. Integral vistas include those views perceived from within Class I areas of landmarks or panoramas located outside the boundary of a Class I area.

The rest of the Monument is a Class II area (including the WSAs). Class II areas also have limits on increases of particulate matter and sulfur dioxide above baseline concentrations. The allowable increases for Class II areas are higher than those established for Class I areas. Other Class I areas in the region are the Sawtooth Wilderness (70 miles northwest) and Yellowstone and Grand Teton National Parks (140 miles east).

Air quality monitoring in the Monument has recorded concentrations of ozone, PM, visibility, acid deposition, and radionuclides (gross alpha, gross beta, and gamma spec). These monitoring programs have been conducted as part of NPS responsibilities under the Clean Air Act, as well as part of the INEEL off-site environmental surveillance program. All the monitoring sites have been at the north end of the Monument.

Ozone is a widespread air pollutant formed in the atmosphere from emissions of nitrogen oxides and volatile organic compounds. High levels of ozone can injure vegetation and affect human health. Ozone concentrations monitored in the Monument have not exceeded the primary national ambient air quality standard for ozone. The primary ozone standard is exceeded when the annual fourth-highest maximum 8-hour ozone concentration averaged over three years exceeds 80 parts per billion (ppb) (USDI NPS 2002a).

The annual fourth-highest maximum 8-hour ozone concentration averaged from 1994 to 2000 was 63 ppb (USDI NPS 1994-2000). The peak ozone concentration (the second-highest 1-hour average) measured at the northern end of the Monument in 2000 was 77 ppb, which was comparable to concentrations in Yellowstone National Park (73 ppb) the same year. The peak ozone ranged from 63 to 89 ppb and averaged 73 ppb during the 1994 to 2000 period. Peak ozone concentrations in 2000 at other NPS units in the Western United States

ranged from 123 ppb at Joshua Tree National Park in Southern California to 56 ppb at North Cascades in Washington (USDI NPS 1994-2000).

The SUM06 statistic (the sum of hourly average ozone concentrations greater than 0.06 parts per million) calculated over a 3-month period is used to correlate with vegetation impacts. The recommended SUM06 value is no more than 8 to 12 parts per million per hour (ppm/hr) to prevent foliar injury to vegetation, which compares to a maximum three-month ozone SUM06 of 12 ppm/hr in the Monument between 1995 and 1999. While at or well below the average for other NPS-monitored units, the trend in ozone concentrations from 1992 through 1999 indicates a statistically significant degradation in ozone-related air quality (USDI NPS 2002a).

The scattering and absorption of light by particles and gases emitted by, or formed as a result of, natural and human-caused activities degrades the visibility of distant features of the landscape. On the clearest days, visibility at the northern end of the Monument is much better than the national average (Visibility Information Exchange Web System: http://vista.cira.colostate.edu/views/Default.htm), compared with 28 other Class 1 areas scattered across the country (USDI NPS 2002a). In 2001, the best visibility days (upper 20 percent) at the Monument averaged 5 deciviews (a haziness index, lower = clearer) compared with a 7.2 deciview national average between 1990 and 1999. For the worst visibility days (lowest 20 percent), the Monument averaged 14.5 deciviews in 2001, which is comparable with the national average of 16.9 deciviews. In 2001, the Monument's annual average visibility range was 106 miles as compared to the 1996 to 1999 annual average at Yellowstone National Park of 102 miles (USDI NPS 2002a).

Trends from 1990 to 1999 in nearby national parks (Yellowstone and Great Basin) indicate improvement in visibility during the clearest days of the year, but the haziest days have improved only slightly or even gotten worse (USDI NPS 2002a). Fine particulates (less than 2.5 micrometers) have been monitored at the Monument as part of the Interagency Monitoring of Protected Environments Program (IMPROVE) since 2000.

EPA has designated portions of Power and Bannock Counties (located 50 miles east of the Monument) as non-attainment areas for the national PM standard (EPA Web site: http://www.epa.gov/ oar/oaqps/ greenbk/pnp.html#16078). The standard is defined as PM that is smaller than 10 micron (PM10).

A National Atmospheric Deposition Program/ National Trends Network (NADP/NTN) site has been operated at the north end of the Monument since 1980. The network measures the chemistry of precipitation to monitor the graphical and temporal long-term trends of hydrogen (acidity as pH), sulfate, nitrate, ammonium, chloride, and base cations (such as calcium, magnesium, potassium, and sodium). In 2000, pH levels of Monument samples ranged from 4.6 to 6.7 with an annual mean of 5.5 (NADP/NTN 2002). This compares with a similar result (5.4) at the NADP/NTN site in Yellowstone National Park.

Ammonium and nitrate ion concentrations are generally higher at the Monument. In 2000, the annual mean concentration of ammonium at the Monument was 0.32 milligrams per liter (mg/L) compared to 0.19 mg/L at Yellowstone and 0.20 mg/L in Owyhee County in southwest Idaho.

Both the U.S. Department of Energy (DOE) and the Idaho Department of Environmental Quality's INEEL Oversight Program (INEEL OP) have operated environmental monitoring programs to determine whether activities on Idaho National Laboratory (INL) lands have affected off-site locations. Similar monitoring occurs on the INL lands, at the edge of the INL lands, and at several distant locations surrounding the INL. One of the co-located distant sites is located at the Monument's Visitor Center 18 miles west of Arco. At this site, radiochemistry analysis of airborne particulates for alpha, beta, gamma, americium-241, cesium-137, plutonium-238, and plutonium-239/240 radionuclides have been independently conducted by DOE and the state's INEEL OP since 1990. DOE and

INEEL also conduct weekly analysis for iodine-131 and quarterly analysis for tritium at this site. In 2002, both monitoring programs concluded that no off-site environmental impacts from INL operations were evident based on the results of particulate air sampling (Stoller 2003; Idaho INEEL Oversight Program 2003).

Statistical comparison of on-site and off-site gross alpha and beta results indicate that the INEEL is not a significant source of off-site contamination. All results were well below applicable regulatory standards and guidelines and were within the range of values measured in previous years. In 2002, annual median gross alpha and beta activity in the air at the Monument site were 1.41 and 2.54 (10-15 μCi/mL), respectively, compared to an annual median value of 1.53 and 2.62, respectively, for the site in Jackson, Wyoming (Stoller 2003).

CULTURAL RESOURCES

Both the NPS and the BLM are responsible for identifying, protecting, managing, and enhancing archaeological, historic, architectural, and traditional lifeway values located on their lands, as well as those that might be affected by BLM or NPS undertakings on non-federal lands. BLM and NPS both manage archaeological remains, historic values, and traditional cultural properties important to Federally Recognized Native American tribes.

Cultural resources are generally identified through field inventories conducted by qualified professionals in compliance with Section 106 of the National Historic Preservation Act of 1966 (NHPA). Interviews and historical records can also be used to identify archaeological, historical, and traditional lifeway values. David Louter (1992) completed a Historic Context Statement for Craters of the Moon National Monument in 1992. This document provides a broad historical overview for the area.

During scoping for this Proposed Plan/FEIS, ethnographic resources of importance were identified by the Shoshone-Bannock and Shoshone-Paiute Tribes. Further discussion of Native American ethnographic resources is included in the section entitled "Native Americans Rights and Interests," following this section.

There has been no systematic, formal inventory to document the presence of any potential cultural landscapes within the Monument to date, such as historic mining districts or historic sheep herding use areas. The general public did not identify any cultural landscapes of concern during scoping for this Proposed Plan/FEIS, and this topic was therefore dismissed as an impact topic. Museum collections would not be affected by any of the alternatives considered and were also dismissed as an impact topic.

ARCHAEOLOGICAL AND HISTORICAL RESOURCES

Three types of inventories – Class I, II, and III – are conducted to identify and assess cultural values on BLM lands. A Class I inventory, a literature review, was completed for the BLM portion of the Monument in 1982, as part of a larger study that included the Boise and Shoshone management areas. Since then, several smaller Class III intensive inventories have been completed in the Monument to fulfill Section 106 responsibilities. These inventories were associated with project activities where sites needed to be identified and evaluated in order to protect significant values and minimize effects on these values. No formal inventories for traditional cultural properties of importance to tribes have been completed for the Monument.

Over the years, several different universities have also conducted Class III inventories on the Monument, unassociated with any specific development project, expanding the information base. It is estimated that less than 5 percent of the Monument has been intensively inventoried for cultural resources. No systematic inventory of the caves associated with the lava flows has been completed. There may be many important cultural resources associated with the lava tubes, as well as the harder to reach kipukas, which have not been recorded by archaeologists because of their remote nature.

Early NPS surveys in the 1960s suggested that there was not a great deal of prehistoric use in this area, but more recent surveys on the adjacent BLM lands would seem to indicate otherwise. These early surveys were concentrated in areas archaeologists deemed likely because they contained known water sources. We now know that Native Americans used this area much more than archaeologists originally believed. Data from recent nearby fire rehabilitation surveys indicate a rather high density of prehistoric sites in association with the lava flows. Therefore, it is believed that there is a significant prehistoric cultural component associated with the Monument area, in addition to the well-documented historic component.

While these inventories have identified many cultural resource sites, little work has been done to synthesize the results and provide a comprehensive framework for assessing cultural resource function, significance, variability, and distributional patterns. There are also many previously recorded cultural resources that should be revisited so that the present condition of these sites can be assessed. Older records are in need of informational details and require updating. Consultation and communication with tribes would improve the agencies' knowledge of traditional cultural properties within the Monument as well. The synthesis of this data will be necessary to identify cultural resources that may be suitable for public education or interpretation, as well as resources that will require special preservation measures. Patterns of anticipated visitor use will guide these decisions as well. Most recorded sites in the Monument are considered eligible for listing on the National Register of Historic Places (NRHP). Presently, however, only Goodale's Cutoff is listed on the NRHP.

Cultural resources condition and trend within the Monument varies considerably because of the variability of terrain and geomorphology, access and visibility, and past and current land use. Exposed artifacts and features on the ground surface can be disturbed by elements such as wind and water erosion, animal and human intrusion, and development and maintenance activities. Based on limited site visitation and site form documentation, the trend of site condition within the Monument is considered stable in most areas. Vandalism and unauthorized collection at sites constitutes the main source of cultural resource degradation.

Looting of archaeological sites has been occurring in the Monument for some time, especially in the remote, hard to reach kipukas. With the advent of Internet auctions, illegal artifact collection is becoming more profitable than ever. As long as there is a market, looting will continue to be a problem.

It is likely there are many sites in the interior of the lavas that are unknown at present, and they might lead to clues needed to understand just what prehistoric people were doing in this area thousands of years ago. Undisturbed caves also may hold a fascinating record of the Monument's early natural history in the form of fossilized skeletal material of Pleistocene mammals. Other caves on the Snake River Plain have produced fossil remains of mammoth, grizzly bear, bison, musk ox, and camel.

Prehistoric and Historic Sites

There are more than 500 known, recorded cultural resources sites in the Monument, representing a variety of types and chronological periods, dating from at least 8,000 years old to the present. Only one site in the Monument has ever been radiocarbon dated. Identified prehistoric sites include lithic scatters, rock shelters, rock structures and piles, and pictographs. Near the north end of the Monument there may be stone tool quarry sites yet undocumented. These remains mainly represent activities in the area before European contact in the 1800s.

Although there is no evidence of earlier occupation at the Monument, there is certainly evidence to suggest an earlier PaleoIndian occupation elsewhere on the Snake River Plain. Sites that are relatively nearby with definite PaleoIndian artifacts are Wilson Butte Cave (Gruhn 1961), the Buhl Burial, and the Simon Site (Butler 1963). The recent discovery of the Buhl Burial in 1991 provided researchers with an undisputable carbon date of 9,600 years ago. The oldest carbon dates recovered from Wilson Butte

Cave (14,500 years ago) were not in clear association with cultural material, and there is some doubt among scholars as to whether the cultural deposits themselves are older than 9,000 years.

The Monument contains portions of an NRHP-listed historic trail. Goodale's Cutoff was an alternate route of the Oregon Trail that skirted the northern edge of the Craters of the Moon Lava Field. These portions of Goodale's Cutoff from US 20/26/93 in Butte County west to Blaine County are on the NRHP. Historic sites in the Monument include portions of historic trails, as well as sheepherder camps, cairns, and dumps. A few stock-raising homestead claims were filed within the Monument in the 1890s and early 1900s, but the environment proved too harsh for them to succeed, and most were canceled. Virtually no visible physical evidence of these endeavors remains (Louter 1992). During the early days of Euro-American settlement in southern Idaho, sheep and cattle grazing were the predominant economic pursuit in this area. During the late 19th and 20th centuries, silver, gold, and lead mining also took place in the mountains just north of the Monument.

The Monument headquarters complex, including the Visitor Center, employee residences, and maintenance buildings, was recently determined to be eligible for nomination to the NRHP (USDI NPS 2000b). A nomination has not yet been forwarded to the keeper of the NRHP for approval. The eligibility is based on the continued integrity of the modern architectural design with grouping of public and administrative facilities in a headquarters area. This approach typified the NPS Mission 66 Program of the late 1950s and early 1960s (Allaback 2000). Mission 66 was a 10-year development program designed to upgrade facilities throughout the National Park System. The National Park Visitor Center, as it is known today, is from the Mission 66 era. The concept of a single building incorporating public facilities, interpretive programs, and administrative functions originated during the Mission 66 Program.

NATIVE AMERICAN RIGHTS AND INTERESTS

NATIVE AMERICAN TREATY RIGHTS AND TRUST RESOURCES

Native Americans inhabited southern Idaho, including the present day Monument lands, for thousands of years prior to European contact. Ethnographic information suggests that aboriginal populations constantly traversed the Snake River Plain during their season subsistence rounds, moving to the Camas Prairie in the spring and then further into the mountains for the summer. In the fall, they would return to the Snake River for the winter (Steward 1938, Liljeblad 1957, 1960, Murphy and Murphy 1960). According to Shoshone-Bannock tribal legends and information, Indians traveled through out the Salmon River Basin and the Snake River Basin, following subsistence resources based on the seasons. Some bands traveled to the Camas Prairie area to gather plants, others traveled to buffalo country, and others went to the Salmon and Snake Rivers for fish. The different bands of Shoshone, Bannock and Paiute all have their place names for specific areas and locations within this region, which includes the Great Rift area. Indians have always used the unique features of the Great Rift area for various uses, and continue to hold this area sacred and important. This ancient way of life was dismantled by settlement of America when large numbers of immigrants seeking land sought to displace the tribes. During the 1850s and 1860s, treaties were negotiated with the tribes in the northwestern United States in part to acquire Indian lands for homesteading.

On July 3, 1868, the Eastern Band of Shoshone and Bannock Tribes and the United States signed the Treaty with the Eastern Band Shoshone and Bannock, 1868, commonly referred to as the Fort Bridger Treaty (15 Stat. 673). In the Fort Bridger Treaty, the tribes relinquished claims to approximately 20 million acres to the United States. The treaty retains the tribes' rights to hunt, fish, and gather natural resources, and provides other associative rights necessary to effectuate these rights on

open and unoccupied lands of the United States. The Shoshone-Bannock Tribes have a long, rich, historical association with the Monument, and their use of those trust resources continues today.

The agencies also maintain a trust relationship with the Shoshone-Paiute Tribe of the Duck Valley Reservation, which was established by Executive Order in 1877. Western Shoshone, Northern Paiute and some Northern Shoshone people were relocated to the remote Duck Valley Reservation, which lies in northeastern Nevada and southwestern Idaho. These people once roamed much of Nevada, Oregon and southern Idaho. The Shoshone-Paiute never formally ceded any of their territory to the U.S. government through treaty. Today, agency consultation and coordination with the Shoshone-Paiute takes place in monthly meetings with tribal representatives using a process known as Wing and Roots.

The BLM and NPS have a unique relationship with federally recognized Native American tribes and are responsible for maintaining a formal government-to-government relationship with tribal leadership. As outlined in treaties, executive orders, legislation, and federal policies, this relationship focuses on ensuring that the rights and/or interests of tribes are considered and protected. This includes consulting with tribal representatives and identifying and protecting important archaeological, religious, and/or sacred sites, as well as providing tribal members appropriate access to these sites. Also included are provisions for reasonable access for tribal members to gather and harvest plant, animal, and aquatic resources on certain state and federal lands where these activities are not otherwise prohibited.

Members of the Shoshone-Bannock Tribes exercise their hunting, fishing, and gathering rights on certain state and federal lands outside the boundaries of their reservations. Tribal treaty rights pursued on public lands within the Preserve and BLM-administered portions of the Monument include hunting of large and small game and gathering various natural resources for both subsistence and medicinal purposes. Game identified by the tribe as having importance includes elk, deer, antelope, moose, sharp tailed grouse, sage-grouse, rabbits, marmots, squirrels, partridges and other associated small game.

The Idaho Department of Fish and Game (IDFG) is charged with enforcement of fish and game regulations within the state of Idaho. However, the IDFG recognizes the authority of the 1975 Tribal Fish and Game Code of the Shoshone-Bannock Tribes of the Fort Hall Indian Reservation to regulate tribal members residing on the reservation when hunting or fishing on federal and state-owned lands outside the reservation, the exception being when those lands have been specifically closed to hunting by state or federal statute.

As a rule, NPS does not allow consumptive uses of natural resources such as plants, rocks, and wildlife from NPS-administered lands (36 CFR 2.1). However, as a matter of policy, NPS generally supports limited and controlled acquisition and use of natural resources for traditional religious and ceremonial purposes (NPS Management Policies, Chapter 8.9).

ETHNOGRAPHIC RESOURCES

Native American ethnographic resources within the Monument have not been characterized in detail to date, but include traditional cultural properties and sacred sites. The existence and importance of these resources can only be determined through consultation with knowledgeable tribal members, and study of existing ethnographic research.

No specific sacred sites or traditional cultural properties within the Monument have been identified by the Shoshone-Bannock Tribes or Shoshone-Paiute Tribes, but there are oral histories documenting the use of the area by tribal members. It is possible tribal members still visit the isolated areas of the Monument for spiritual purposes today. The local tribes generally do not disclose sacred site locations to federal agencies. Not knowing the location of these sacred areas makes it difficult for land managers to assess the impacts of federal actions on them. Continued consultation with tribes is the best way to maintain an open dialog so tribal members can voice their concerns should a federal action threaten

a sacred site or traditional use area.

The American Indian Religious Freedom Act of 1978 (42 USC 1996) states United States policy to recognize and protect Native American religion. In part, the law states that the policy of the United States is to protect and preserve the right of Native Americans to access sites, as well as use and possess sacred objects for ceremonial and traditional practices. Accordingly, the agencies will accommodate access to and ceremonial use of Native American sacred sites, consistent with the purposes of the Monument (Executive Order 13007).

There are no Native American Graves Protection and Repatriation Act (NAGPRA) materials in the existing museum collections from the Monument and Preserve. In the event that materials are inadvertently discovered or encountered during authorized archaeological excavations, the affiliated tribes would be contacted immediately and the procedures outlined in NAGPRA would be followed.

LAND USE AND TRANSPORTATION

TRAVEL AND ACCESS

One of the most important issues to be considered in this planning effort is the amount and type of access to and within the Monument. This plan characterizes the existing road and trail network using the best available data on current condition and historical maintenance practices. Figure 16 depicts the current road network in the planning area.

With the exception of road closures implicit in the application of Pristine Zone areas (see management zone descriptions in Chapter 2), decisions affecting the status or condition of all roads and trails within the Monument will be made in a follow-up implementation plan (see Chapter 1 Future Planning Needs). As stated in the Desired Future Conditions, there will be no net increase in road mileage within the Monument. All travel and access will be limited to the existing roads and trails as shown in Figure 16. This map represents the best available information at the time of publication and was compiled using USGS 1:24,000 scale topographic maps BLM and NPS roads information including a 2002 survey of roads, ways, and trails in and around existing Wilderness Study Areas. These roads and trails were evaluated by agency staff and organized into the following classification system to provide for a reasonable baseline data set to be used within the context of a more specific Comprehensive Travel Management Plan to follow.

Major Transportation Routes
Interstate Highways 15, 86, and 84 on the south and east, US 20/26/93 on the west and north, and US 26 on the northeast connect population centers and constitute primary access to the planning area. Idaho State Highway (SH) 24 (parallel with the Union Pacific Railroad) connects Shoshone with Rupert by way of Minidoka, and to the east, SH 39 connects Blackfoot and American Falls by Aberdeen.

US 20/26/93 traverses the north end of the Monument, and in the developed area of the Monument around the Visitor Center, there is a paved 7-mile Loop Drive and developed trails. No public transportation is available to the Monument. While paved roads surround the Monument, the roads within the Monument are either gravel or dirt, and very few roads cross the lava flows. There is no vehicle access to most of the interior of the Monument in winter or spring because of snow and wet road conditions.

On the east side of the Craters of the Moon Lava Flow, a 69-mile dirt/gravel road connects Arco and Minidoka. The Arco-Minidoka Road has a wide variety of road conditions. The north and south ends of the road, maintained by Butte and Minidoka Counties, are relatively well-maintained gravel roads. The middle part of the Arco-Minidoka Road, within the Monument, is a difficult to follow dirt, two-track road that receives relatively little maintenance. The main travel way on the west side of the Monument is the 39-mile Carey-Kimama Road, of which 11 miles are within the Monument. Carey-Kimama Road is a continuous gravel road that receives regular maintenance.

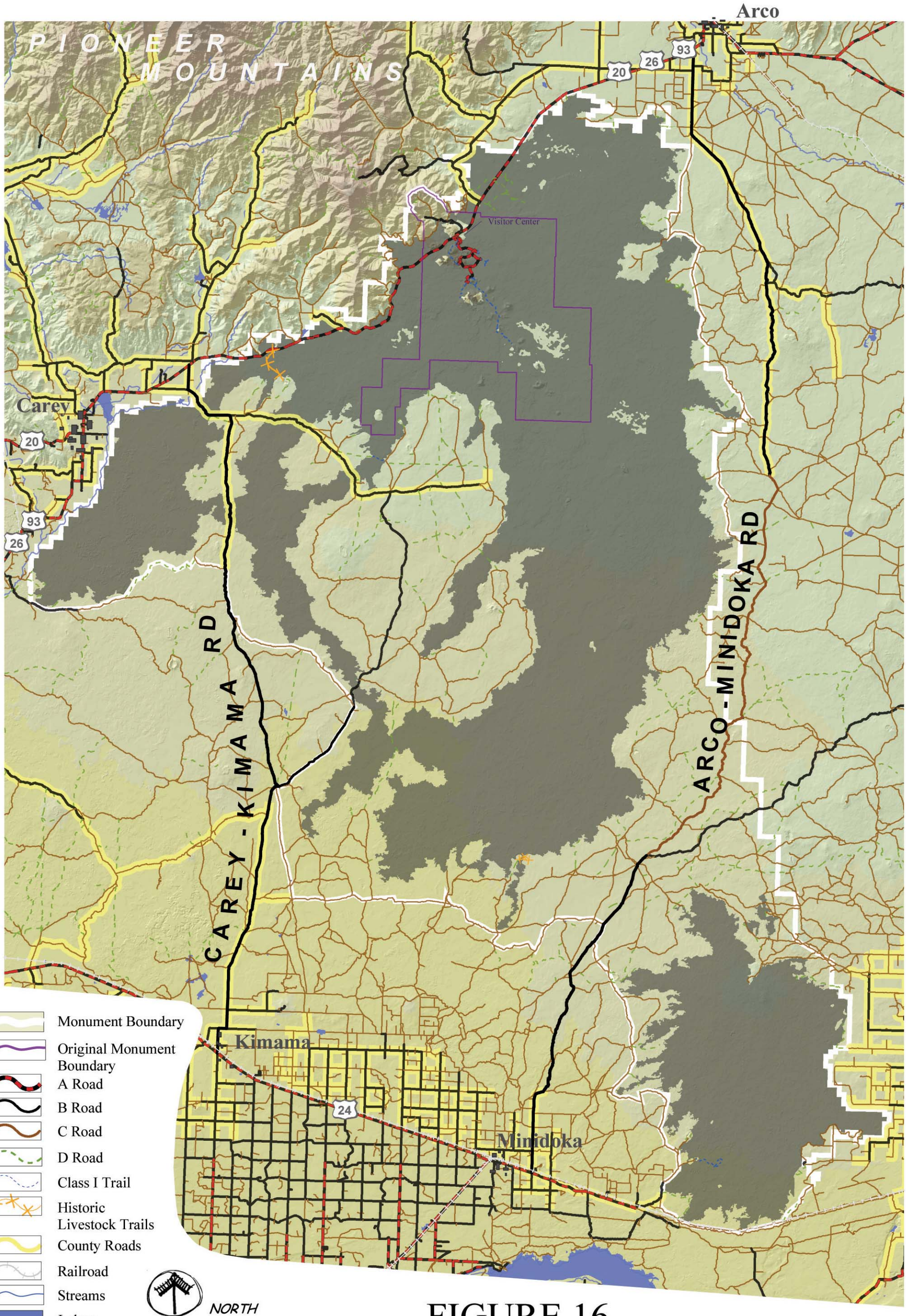


FIGURE 16
TRANSPORTATION & ACCESS
Craters of the Moon National Monument & Preserve

U.S. Department of the Interior * National Park Service * Bureau of Land Management

No warranty is made by the Bureau of Land Management or National Park Service for use of the data for purposes not intended by these agencies.

The southern part of the Monument, including Crystal Ice Cave and Kings Bowl, is accessed by paved and gravel county roads, which lead to dirt/gravel BLM and county roads near and within the Monument.

Road Classification
Within the Monument, a "road" is defined as an established route capable of accommodating travel by a full-sized automobile or truck. Following other routes or establishing new routes with motorized or mechanized vehicles is considered "off-road" use, which is not permitted in the Monument (see below). There are four different types of roads within the Monument: These conditions were arrived at using the best available resource base data (USGS 1:24,000 scale GIS layers) while incorporating institutional knowledge among agency experts for verification and revision.

Class A Roads generally are paved and have a surface of asphalt, concrete, or similar continuous material. In addition to US 20/26/93, the only Class A roads are Loop Drive, spur roads, and associated parking areas in the original NPS Monument. Class A roads are only found in the Frontcountry Zone.

Class B Roads are improved roads constructed with a natural or aggregate surface, and they may have berms, ditches, or culverts. Regular maintenance allows passage by standard passenger and commercial vehicles such as cars, light trucks, and some heavy trucks. Seasonal conditions and lack of snow removal may render these roads impassable. Class B roads are found primarily in the Passage Zone.

Class C Roads have a natural surface and may be either constructed or established over time by repeated passage of vehicles. The natural surface may be dirt, sand, or rock. A minimal amount of maintenance, if any at all, is limited primarily to surface grading to allow vehicle passage within the original road corridor. Maintenance on these roads is performed only as necessary, not in accordance with any regular schedule. Class C roads accommodate a much smaller range of vehicles than Class B roads, usually high-clearance two-wheel-drive and four-wheel-drive vehicles. Seasonal conditions or wet weather may render these roads impassable at any time. Class C roads are found primarily in the Passage and Primitive Zones.

Class D Roads are primitive roads that were not constructed but have been established over time by the passage of motorized vehicles. These roads receive no maintenance or grading. These roads are generally referred to as "two-tracks" or a set of two ruts with vegetation growing in between the wheel ruts. The condition of these roads varies from sometimes passable by a passenger car, to only suitable for high-clearance four-wheel-drive vehicles, to passable only by adventurous off-highway vehicle (OHV) enthusiasts with special equipment. Seasonal conditions or wet weather may render these roads impassable at any time. Class D roads are found primarily in the Primitive Zone.

Ways are defined in the BLM Handbook 8550-1 Interim Management Policy for Lands Under Wilderness Review (USDI BLM 1995) as a "trace maintained solely by the passage of vehicles which has not been improved and/or maintained by mechanical means to ensure relatively regular and continuous use." The BLM identified all ways inside Wilderness Study Areas (WSAs) as part of the wilderness inventory process. Ways are generally open to motorized and mechanical use until Congress designates a WSA as Wilderness or releases it from wilderness consideration. Technically, ways fall into the Class D road classification in this plan. However, this does not imply that roads would be permitted in WSAs, rather it is simply a way of fitting what we have already inventoried and identified as ways into one comprehensive classification system in an effort to characterize all access and transportation within the Monument.

Trail Classification
A "trail" is a constructed (or established by past use) linear feature, with a single tread designated, designed, and intended for travel by hikers, horses, and two-wheeled vehicles (for example, mountain bikes and motorcycles). Trails are sometimes referred to as "single track." Trails within the Monument are classified into two types based on use.

Class 1 Trails are restricted to non-motorized/non-mechanized travel (wheelchairs are allowed). Examples of permitted forms of travel include foot travel, pack animal, and horseback. Examples of prohibited forms of travel on Type 1 trails are mountain bikes and all motorized vehicles. Class 1 trails may be further restricted; for example, to foot travel only.

Class 2 Trails are open to motorized/mechanized travel in addition to foot travel, pack animal, horseback, and other forms of passage. Examples of prohibited forms of travel are any vehicle with a footprint wider than an 18-inch tread (all-terrain vehicles, four-wheelers, and four-wheel-drive vehicles).

Table 18 summarizes the current status of roads and their designated classes in the Monument.

Costs vary tremendously for road maintenance, whether performed by BLM or by the counties. The counties and local highway districts receive funding from the Federal Highway Administration (FHWA) at a fixed dollar per mile cost for the number of miles of road they maintain. For example, costs associated with annual maintenance of a Class C road can be relatively low, between $200 and $400 per mile. This would involve smoothing the road surface with a road grader. One-time deferred maintenance (every 10 to 15 years) such as reshaping the road, cleaning ditches, and adding aggregate material on a Class B standard road can cost $10,000 per mile. To completely rebuild a road, or to bring a road from a Class D standard to a Class B standard, can cost as

Class A Road

Class C Road

Class B Road

Class D Road

much as $50,000 per mile. These maintenance costs apply to roads leading to the Monument as well as roads within the Monument.

BLM policy requires land use plans to make OHV (also referred to as "off-road vehicle") designations for all BLM lands within the planning area in the land use planning process (Land Use Planning Handbook H1601-1). The three OHV designations are "open", "limited", and "closed". Open means an area where all types of vehicle use are permitted at all times, and closed means an area where off-road vehicle use is prohibited (43 CFR 8340-0-5(f)(g)(h). All lands within the planning area have been designated by the Proclamation as "limited." A "limited" designation means that all off-road vehicle use will be limited to existing roads and trails. On NPS-administered lands, operating a motorized vehicle is permitted only on Park Roads, in parking areas, and on routes and areas designated for off-road motor vehicle use. No routes or areas are presently designated for off-road vehicle use, nor are they permitted on lands that have been classified as eligible for wilderness designation. Similar restrictions apply to bicycle use. The Comprehensive Travel Management Plan completed following the finalization of this plan will identify seasonal limitations and closures, vehicle type and size restrictions, road construction, and maintenance standards for all roads and trails within the Monument. The Idaho

Table 18
Roads and Trails within Craters of the Moon National Monument and Preserve

ROADS WITHIN THE MONUMENT	MILES	MAINTENANCE
Class A	30	Idaho Transportation Department maintains 21 miles; NPS maintains 9 miles.
Class B	58	BLM maintains 28 miles; remaining 30 miles maintained by Blaine (28) and Butte (2) Counties.
Class C	367	BLM maintains 365 miles, NPS maintains 1 mile, Blaine County maintains 1 mile.
Class D	173	Not maintained.
Arco-Minidoka Road	69	BLM maintains 15 Class B miles and 25 Class C miles; remaining 29 miles maintained by Butte (24) and Blaine (5) Counties.
Carey-Kimama Road	40	BLM maintains 15 miles (all Class B); remaining 25 miles maintained by Blaine (12) and Lincoln (13) Counties.

Transportation Department (ITD), counties, and local highway districts manage roads leading to and passing through the Monument under the terms of right-of-way grants.

Off-Road Access
Except for emergency or authorized administrative purposes, the operation of motorized and mechanized vehicles off-road is prohibited within the Monument (Proclamation 7373). A common use on much of the public lands within the Monument is operation of OHVs. The operation of OHVs is currently permitted on all existing inventoried roads, with the exception of the restrictions noted above on NPS-administered lands.

Administrative purposes include the authorized activities of the agencies; permit holders (e.g., livestock permittees), and other agencies. In all cases, off-road travel must be specifically authorized by the agencies. The agencies coordinate with livestock permittees, USDA WS, IDFG, and others who may require authorizations for off-road vehicle use.

Existing BLM land use plans address off-road (cross-country) travel on public lands outside of the Monument. Generally, the public lands outside the Monument are designated "open" to OHV use.

LIVESTOCK GRAZING

Livestock use at the Monument
The Proclamation expanding the Monument states: "Laws, regulations, and policies followed by the Bureau of Land Management in issuing and administering grazing permits or leases on all lands under its jurisdiction shall continue to apply with regard to the lands in the Monument administered by the Bureau of Land Management." The Monument is cooperatively managed by NPS and BLM. NPS administers 462,880 acres, or 61 percent, of the Monument, and that area is not available for livestock use. These areas consist primarily of exposed lava flows, which are mostly devoid of available forage and/or inaccessible to livestock; therefore, prohibiting grazing in these areas has little to no impact on the livestock industry.

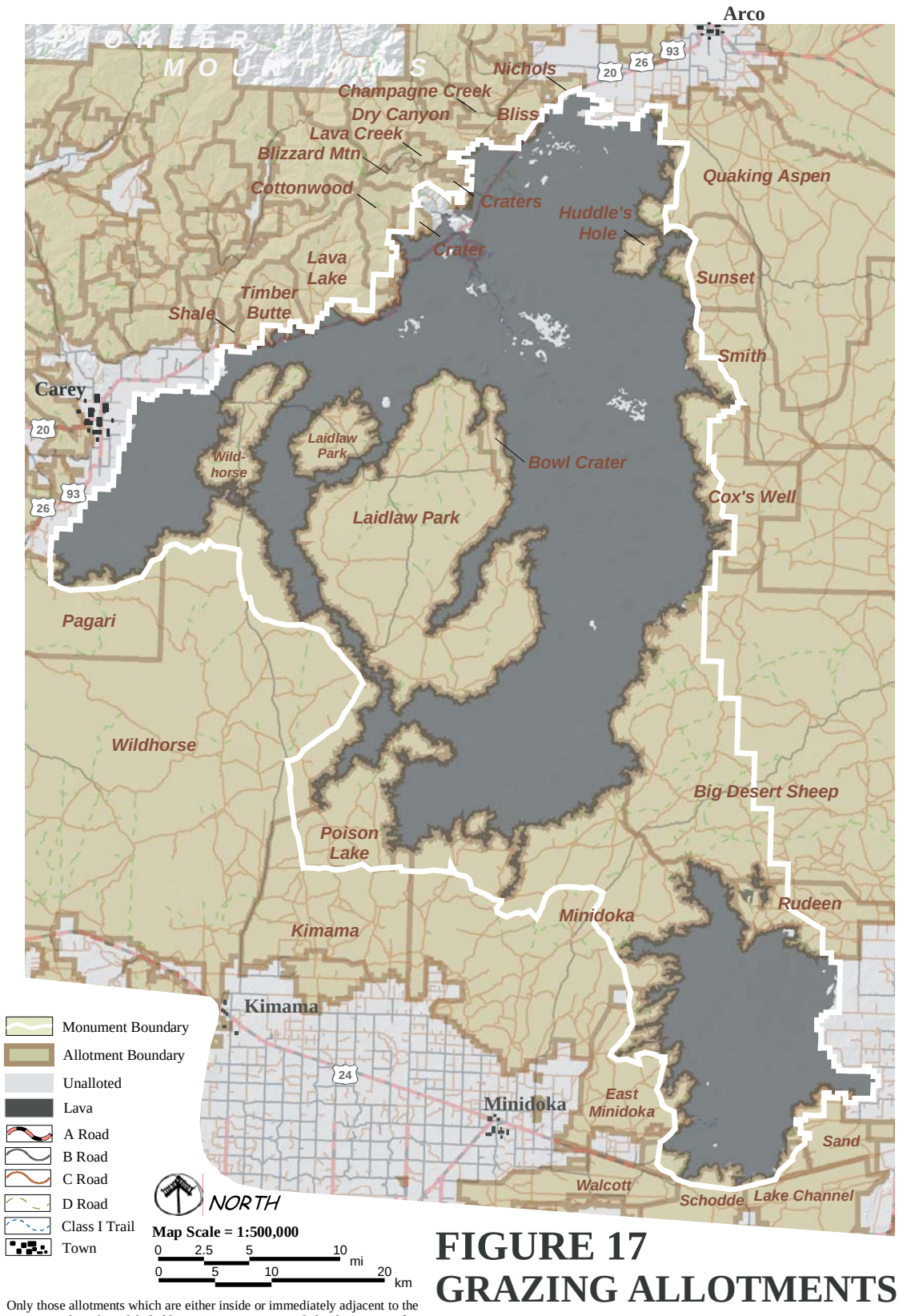
Three BLM field offices (Idaho Falls, Burley, and Shoshone) in the Idaho Falls and Twin Falls Districts administer livestock use on the 285,700 acres (including BLM, Private and State Lands) in the Monument. Sheep and/or cattle graze these lands, which are divided into management units known as allotments. Grazing permits are awarded to permittees by allotment. These permits, or leases, convey no right, title, or interest in the land or resources. Although the Proclamation specifically mentions livestock grazing, it does not establish the practice as a "right" or convey to it any new status. There are an additional 1,800 acres of BLM-administered land adjacent to privately owned agriculture fields and NPS-administered lava, which are designated not available for grazing. Figure 17 shows all grazing allotments in the Monument.

Table 19 shows the breakdown of allotment acres, animal unit months (AUMs), and permittees by field office.

Table 20 shows the current individual allotment information within the Monument, including AUM figures, which are estimates based on the percentages of each allotment that lies within the Monument.

Grazing systems, or acceptable grazing practices, for allotments are detailed in Allotment Management Plans (AMPs). Grazing systems result from certain decisions and agreements and are subject to standards and guidelines, as are adjustments made to stocking rates. AUMs, shown in Tables 19 and 20, reflect current authorizations and are not a mandated level of use.

Livestock use at the Monument



Only those allotments which are either inside or immediately adjacent to the Monument have been labeled here. No warranty is made by the Bureau of Land Management or National Park Service for use of the data for purposes not intended by these agencies.

FIGURE 17
GRAZING ALLOTMENTS

Craters of the Moon National Monument & Preserve

U.S. Department of the Interior * National Park Service * Bureau of Land Management

Standards and guidelines have been applied to 18 out of 23 allotments, as is shown in Table 21. This analysis begins with consultation between an authorized officer, interested publics, and resource users. Field assessments and evaluations are then conducted to determine the achievement or non-achievement for each standard. A plan to reach uniform achievement, when needed, is typically developed through an environmental assessment (EA). EAs identify changes necessary for allotments to meet, or to make significant progress toward meeting, all standards. EAs also require follow-up monitoring and the reporting of results. Appendix F contains the handbook, "Standards for Rangeland Health and Guidelines for Livestock Grazing Management."

Grazing preference is not expected to decrease as a result of standards and guidelines analysis because most allotments are attaining, or are making significant progress toward attaining, uniform achievement.

Rangeland developments are used in the Monument to improve livestock distribution, provide livestock forage, restore degraded areas, protect sensitive sites, improve wildlife habitat, and facilitate intensive management of livestock through the implementation of grazing systems. Many of these are also closely associated with the road system in the Monument. See Figure 18.

Proclamation 7373 recognized existing roads and two-tracks across narrow strips of exposed lava that are used to trail livestock from one grazing area to another. Trailing of livestock between allotments is another common practice in the livestock industry, and historic trail routes are still used today in many areas of the Monument. The majority of this trailing occurs along existing roads. In the map accompanying the Proclamation, these corridors were designated for primary management by the BLM to allow for continued livestock trailing and other authorized uses in these corridors. However, there are two known areas in the Monument where historic livestock trails do not follow designated roads and cross lava flows that are now administered by the NPS. These two much less obvious trails historically used for trailing livestock were not identified on the Proclamation map. While not in use at the time of Proclamation 7373, the question of their future use has been raised during the preparation of this plan. Both were once used for trailing sheep. One leads between US 93 and Paddelford Flat and the other across Brigham Point in the southern portion of the Craters of the Moon Lava Flow.

The Paddelford Flat Trail, in the northern part of the Monument (T.1S, R.23E, Sec. 5,8), allows the passage of livestock from the north end of Paddelford Flat to US 20/26/93, about 1 mile west of Lava Lake. Without this trail, it would take about 13 miles to trail out around the lava and along the highway back to Lava Lake. This trail, which is approximately 1.5 to 2 miles long, is passable by foot traffic only because it is narrow and goes through rugged lava. The photo below depicts a traditional sheep camp that is used in today's sheep herding operations.

The Brigham Point Trail, in the southern part of the Monument (T.5S, R.25E, Sec.15), is at the north end of the Brigham Point Lava Flow. This trail, which is less than 0.25-mile long, has similar characteristics to the Paddelford Flat Trail, and therefore it is passable only by foot traffic. This trail allows passage between the east and west sides of Brigham Point without having to go around the entire flow, which would be approximately 9 miles.

Table 19
Livestock Use per BLM Field Office

INFORMATION	SHOSHONE	IDAHO FALLS	BURLEY	TOTALS
Number of Allotments	10	9	4	23
Total Acres	154,300	77,400	54,000	285,700
Number of AUMs	19,043	9,095	8,827	36,965
Number of Permittees	30	35	14	79

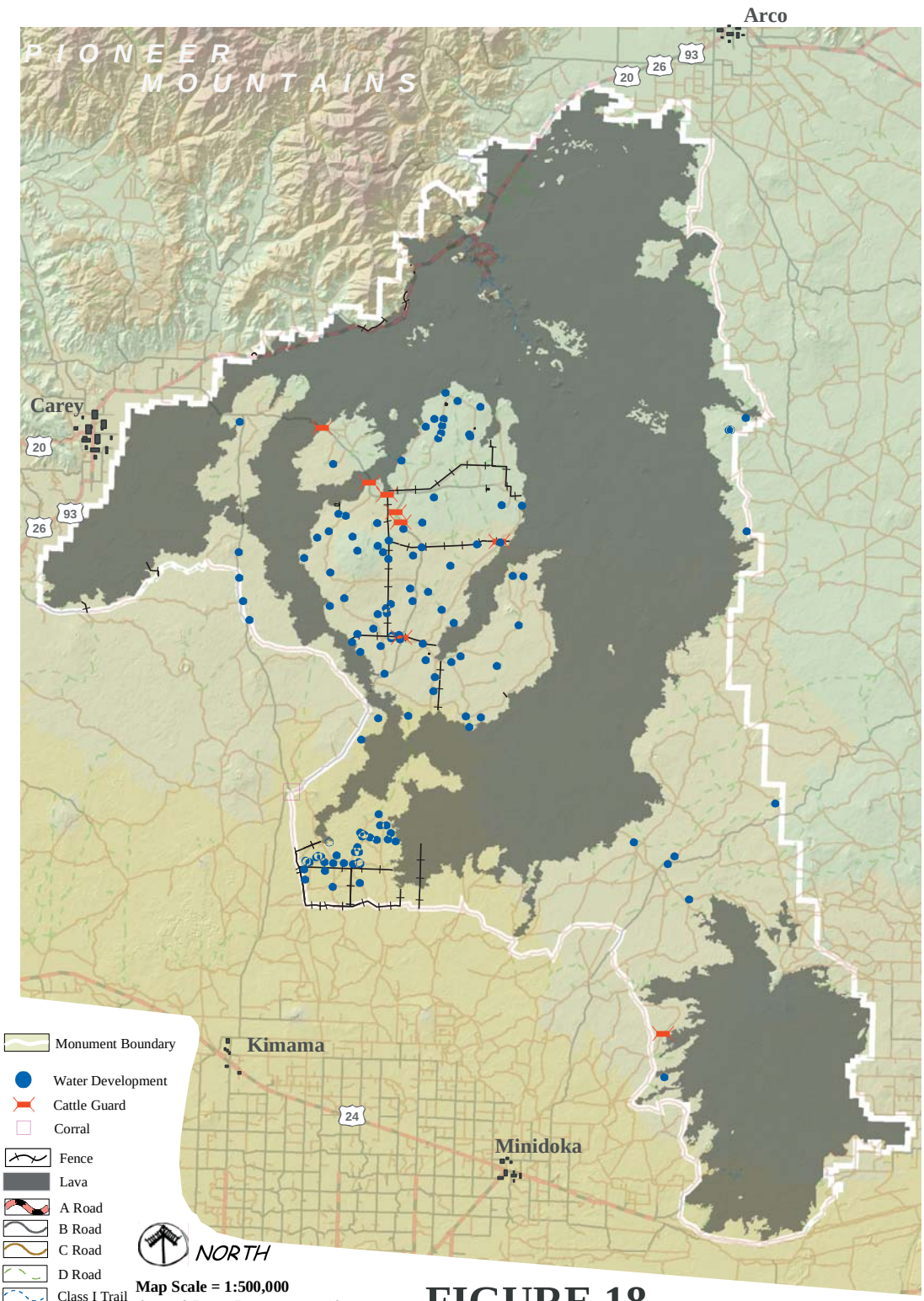


FIGURE 18

RANGE IMPROVEMENT FACILITIES

Craters of the Moon National Monument & Preserve

U.S. Department of the Interior * National Park Service * Bureau of Land Management

Range Improvements data displayed here is sufficient for illustrating the approximate quantity and distribution of facilities inside the Monument. No warranty is made by the Bureau of Land Management or National Park Service for use of the data for purposes not intended by these agencies.

Table 20
Craters of the Moon Allotment Animal Unit Months

FIELD OFFICE	ALLOTMENTS	ALLOTMENT			ESTIMATED AUMS WITHIN THE MONUMENT					
		Total Acres	Acres in Monument	% of acres in Monument	Active Cattle AUMs	Suspended Cattle AUMs	Active Sheep AUMs	Suspended Sheep AUMs	Exchange of Use	Total AUMs per Allotment
Idaho Falls	Blizzard Mountain	3,500	0	0	-	-	-	-	-	-
	Huddles Hole	2,300	2,300	100	24	20	-	-	-	44
	Sunset	12,700	1,600	13	197	9	-	-	-	206
	Quaking Aspen	81,500	2,900	4	241	18	-	-	-	259
	Smith	19,800	2,800	14	352	-	-	-	-	352
	Coxes Well	21,500	6,700	31	659	-	-	-	-	659
	Big Desert	236,000	54,000	23	-	-	6,710	-	-	6,710
	Rudeen	15,000	6,400	42	369	411	-	-	-	780
	Craters	2,200	700	34	-	-	85	-	-	85
	TOTAL	**394,500**	**77,400**	**20**	**1,842**	**458**	**6,795**	**-**	**-**	**9,095**
Burley	East Minidoka	21,300	5,100	24	1,117	-	-	-	-	1,117
	Minidoka	99,800	43,500	44	-	-	6,021	1,046	-	7,067
	Sand	8,800	1,800	20	96	-	-	-	-	96
	Schodde	21,100	3,600	17	547	-	-	-	-	547
	TOTAL	**151,000**	**54,000**	**36**	**1,760**	**-**	**6,021**	**1,046**	**-**	**8,827**
Shoshone	Bowl Crater	2,900	2,900	100	133	-	-	-	-	133
	Cottonwood	6,900	700	10	-	-	18	-	-	18
	Crater	2,500	1,600	65	-	-	85	-	-	85
	Kimama	33,100	800	2	-	-	115	-	2	117
	Laidlaw Park	94,600	94,600	100	8,507	-	2,924	-	-	11,431
	Lava Lake	14,500	1,900	13	95	-	-	-	-	95
	Pagari	26,700	1,900	7	159	21	-	-	-	180
	Poison Lake	18,600	18,600	100	2,856	-	406	-	-	3,262
	Timber Butte	7,900	500	6	33	21	-	-	-	54
	Wildhorse	241,000	30,800	13	51	-	3,617	-	-	3,668
	TOTAL	**448,700**	**154,300**	**34**	**11,834**	**42**	**7,165**	**-**	**2**	**19,043**
GRAND TOTAL		**994,200**	**285,700**	**29**	**15,436**	**500**	**19,981**	**1,046**	**2**	**36,965**

These acreage calculations are based on allotment boundaries which include BLM, State, and Private lands.

Table 21
Allotment Standards & Guides Facts — Idaho Falls and Twin Falls Districts

ALLOTMENT	% OF ALLOTMENT AFFECTED	AUMS IN PROPOSAL	NUMBER OF PERMITTEES	YEAR STANDARDS & GUIDELINES COMPLETE	PERMIT EXPIRATION DATE	STANDARDS MET
IDAHO FALLS						
Blizzard Mountain	4	26	1	1999	2009	Yes
Craters	35	88	1	1999	2009	Yes
Huddles Hole	100	44	1	1999	2009	Yes
Sunset	13	206	1	1999	2009	Yes
Quaking Aspen	4	259	11	1999	2009	Yes
Smith	14	352	1	2008	2008	In Progress
Coxes Well	31	659	1	2005	2005	In Progress
Big Desert	23	6,710	18	1999	2009	Yes
Rudeen	43	799	1	2005	2005	In Progress
BURLEY						
East Minidoka	23	1,025	1	1999	2005	Yes
Minidoka	43	6,845	9	2002	2/05, 4/07, 1/08, 2/09	No
Sand	19	86	1	2006	2007	Yes
Schodde	17	547	3	2000	1/06, 2/09	Yes
SHOSHONE						
Bowl Crater	100	133	1	2004	2/28/15	No
Cottonwood	11	20	1	1999	2/28/09	No
Crater	65	85	1	1999	2/28/09	No
Kimama	2	117	6	1999	Varies	No
Laidlaw Park	100	11,431	14	2003	Varies	No
Lava Lake	12	88	1	2004	2/28/15	Yes
Pagari	7	180	3	2004	Varies	No
Poison Lake	100	3,262	1	2005	2/28/05	In Progress
Timber Butte	7	63	1	2006	2/28/12	In Progress
Wildhorse	13	3,668	22	1999	Varies	No

OTHER LAND USES

Administrative and Visitor Facilities
Existing administrative and visitor facilities in the Monument are concentrated in an area of approximately 90 acres adjacent to US 20/26/93 in the north area of the Monument. These are the Visitor Center/Administrative Building, maintenance shop, five residential buildings, the entrance station, paved parking areas and roads, a 51-unit campground, a campsite, and related sites. The Visitor Center (which also serves as the NPS administrative headquarters), the maintenance building, and five residential buildings were built in the late 1950s as part of the NPS Mission 66 Program.

The Visitor Center building contains a lobby with book displays, sales, and an information desk; a small exhibit room; and public restrooms. The administrative office area of the building consists of six rooms serving as offices and shared work areas. Renovation of the building and additions of 1,800 square feet for staff work area and 450 square feet for a multipurpose audiovisual room are in progress.

The six-bay maintenance building provides limited area for its intended purposes, since parts of the building have been converted to offices for maintenance staff, administrative staff, and storage of park supplies. One of the residential buildings has been converted to staff offices and museum collections storage. Sewage is handled by separate septic tanks and leaching wells for the Visitor Center/maintenance building and for the residential area. Each of the campground restrooms is served a separate system.

Traditional sheep camp

The 51-unit campground contains a 130-seat amphitheater and two restrooms. An entrance station where visitors are contacted before entering the paved loop drive is located adjacent to the campground. North of the highway is a public group campsite. In this vicinity is also a modest research camp, the park's potable water wells and delivery systems, and underground water storage reservoirs.

A 7-mile paved loop drive with short spur roads, pullouts, and parking areas gives visitors access to scenic vistas, hiking trailheads, and other attractions. Vault toilets are available at three of the parking areas.

Kings Bowl was once a developed site. From the mid-1960s to late-1980s, private operators under permits from the BLM operated a concession at the site with a developed trail/tunnel system into Crystal Ice Cave, a parking and picnicking area, a trailer pad, a generator building, and a small concession stand. All of the aboveground facilities have been removed because of safety concerns. A small parking area and remnants of footpaths and vehicle trails remain. NPS and BLM are in the process of installing a series of waysides and signs in the area to convey important safety and resources protection messages to people who might visit this site.

Lands and Realty
The planning area encompasses approximately 752,490 acres. Figure 19 shows land status, and land ownership is detailed in Table 22.

Private and state land within the Monument boundary is not part of the Monument and is not subject to the direction in this plan. Most of the private land holdings in the planning area were obtained through agricultural entries such as the Desert Land Act, the Carey Act, the Reclamation Homestead Act, and the Stock Raising Homestead Act. There were no pending agricultural entries in the Monument on the date of Proclamation 7373. The private and state land inholdings are used for grazing and contain

related developments such as fences, wells, corrals, camp trailers, and seedings. There are no houses, cabins, or other permanent human dwellings on the private or state land.

The agencies will consider acquiring private and state land in the Monument through exchange, purchase, or donation. Acquisitions of private land must be initiated by the private landowner as a willing seller. The Idaho Department of Lands (IDL) has initiated a proposal to exchange state land in the Monument for BLM land outside of the Monument (see letter from IDL in Appendix I). Private or state land acquired by the agencies would automatically become part of the Monument and subject to the direction in this plan.

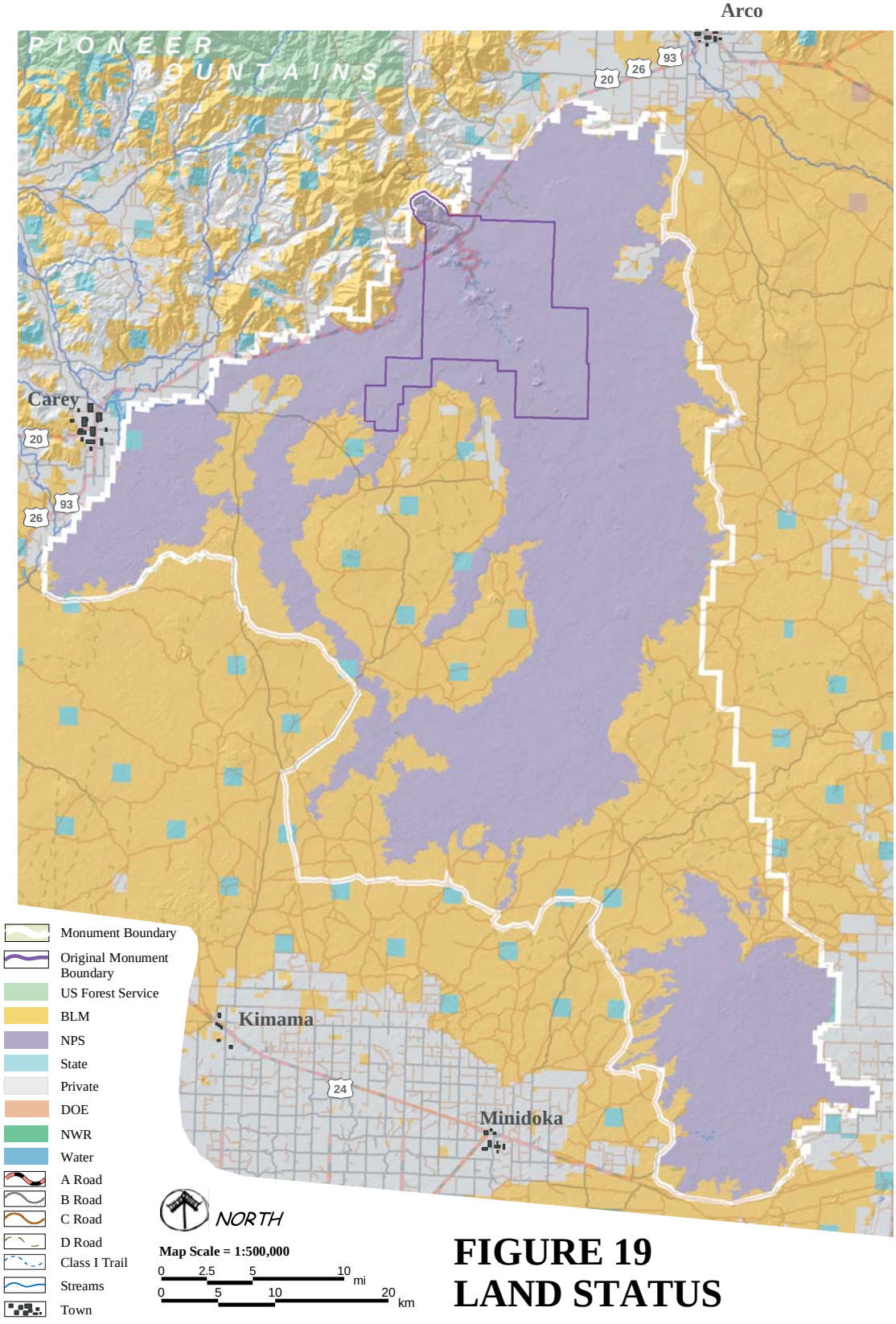
Proclamation 7373 transferred 409,460 acres in the Monument from BLM to NPS administration. In 2002, Congress changed the designation of this land from National Monument to the Craters of the Moon National Preserve.

Proclamation 7373 withdrew all federal land within the Monument and Preserve from all forms of entry, location, selection, sale, and other forms of disposition. Therefore, the agencies cannot exchange, sell, or dispose of any federal land in the Monument except for extremely rare situations that would further the protective purposes of the Monument. This withdrawal includes the disposal of land to local governments for public purposes and community expansion.

The Monument contains multiple land use authorizations for a wide variety of purposes. Lands and realty authorizations fall into two broad categories, valid existing rights and other valid but lesser interests. Proclamation 7373 states that: "The establishment of this monument is subject to valid existing rights." Land use authorizations that give "rights" to the holder under various laws, leases, and filings under federal law, such as some rights-of-way (ROWs), are listed in Table 23 and shown on Figure 20.

Table 22
Landownership

LAND STATUS	ACRES	% OF MONUMENT
NPS Lands	462,880	61
Original Monument	53,420	7
National Preserve	409,460	54
BLM Lands	274,800	37
Federal Total	**737,680**	**98**
State Total	8,250	1
Private Total	6,560	1
Grand Total	**752,490**	**100**



No warranty is made by the Bureau of Land Management or National Park Service for use of the data for purposes not intended by these agencies.

FIGURE 19
LAND STATUS

Craters of the Moon National Monument & Preserve

U.S. Department of the Interior * National Park Service * Bureau of Land Management

Other existing authorizations in the Monument are three Free Use Permits for mineral materials (see the "Minerals" section, below) and 14 easements held by BLM across state and private land. Only one pending authorization/application for a land use authorization within the Monument existed on November 9, 2000. This is a proposed cooperative agreement for a groundwater recharge area along the Little Wood River, approximately 5 miles south of Carey. At the time of Proclamation 7373, there were no other pending lands and realty cases or applications such as ROWs, Land Use Permits, exchange or sale proposals, or trespass cases.

A potential powerline corridor was identified in 1984, running southwest to northeast between the Craters of the Moon and Wapi lava fields in the Monument (Montgomery 1984). However, because of conflicts with the Great Rift WSA, this corridor has not been carried forward in other regional powerline and utility corridor studies (Western Regional Corridor Study 1992). A utility corridor, an existing 500-kilovolt-transmission line, and a railroad ROW border the Monument on its southern extremity near the Wapi Lava Field.

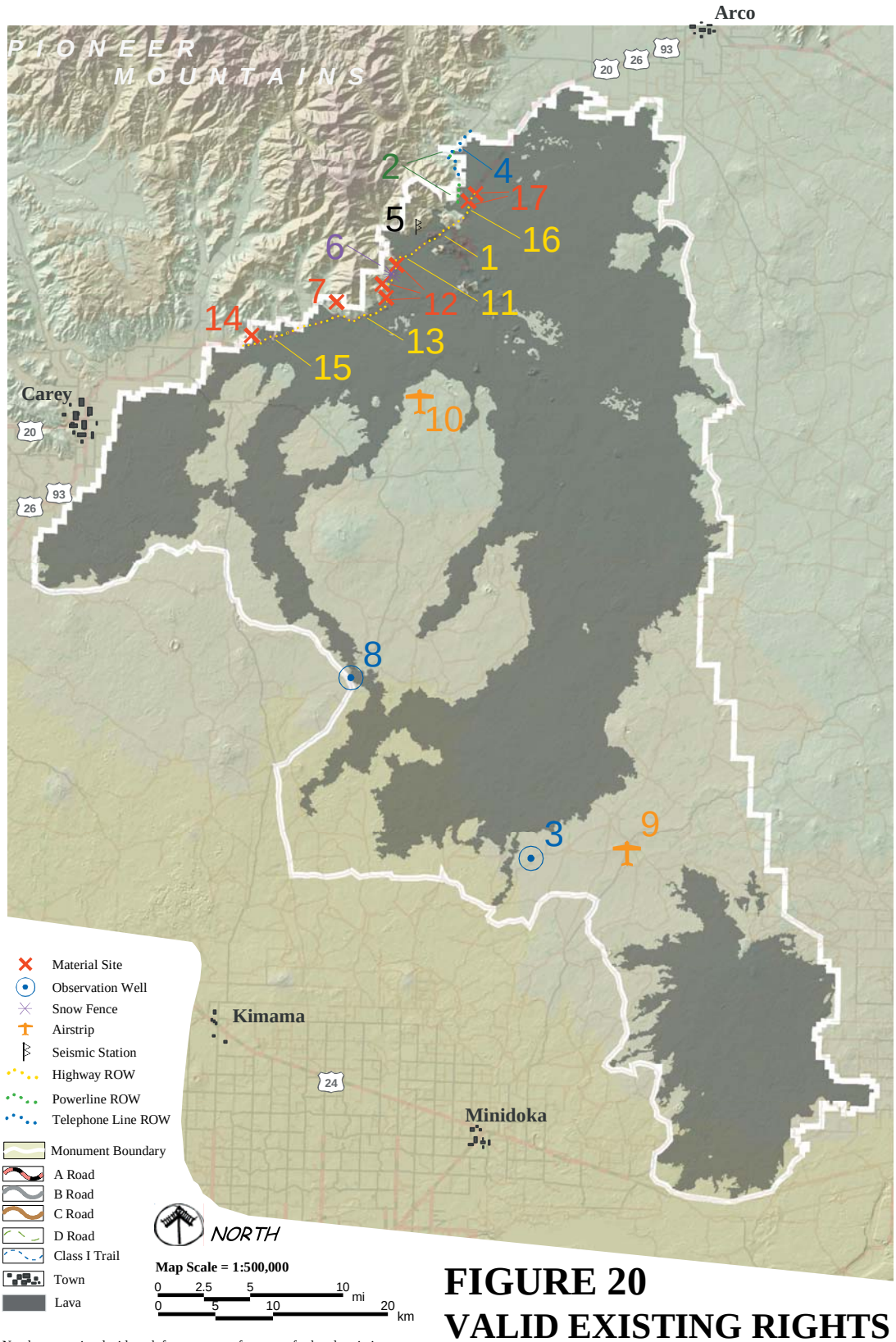
Minerals

The Proclamation expanding the Monument withdrew all federal lands and interests in lands within the Monument from entry, location, selection, sale, leasing, or other dispositions (except for exchanges that would further the protective purposes of the Monument) under the public land laws, including the mineral leasing and mining laws. Thus, new federal mineral leases or prospecting permits may not be issued, nor may new mining claims be located within the Monument. No mining claims existed in the Monument on the date of Proclamation 7373.

There are no known natural gas, oil, or mineral deposits within the Monument boundaries. The general area has moderate potential for developable geothermal resources (Kuntz et al. 1979, Ridenour 1979). Active mining claims for locatable minerals, primarily gold, exist just to north of the Monument in the Pioneer Mountain foothills. NPS has rehabilitated two old abandoned gold mine adits in the northern portion of the original Monument. BLM processed several applications for geothermal leases in the 1970s and issued one lease, which was relinquished in 1982.

Table 23
Valid Existing Rights

LOCATION ON FIGURE 20	CASE TYPE	CUSTOMER NAME	CASE FILE NUMBER	SIZE IN ACRES	EXPIRATION DATE
1	Federal Aid Highway 93	ITD	IDI-001314	94	Perpetuity
2	ROW Powerline	Lost River Electric Cooperative	IDI-002855	19	12/16/2019
3	ROW Observation Well	USGS	IDI-012671	10	12/02/2009
4	ROW Telephone Line	ATC Communications	IDI-020118	6	08/08/2012
5	ROW Seismic Station	DOE	IDI-028657	<1	04/16/2012
6	ROW Snow Fence	ITD	IDI-032380	14	09/09/2017
7	ROW Mineral Material Site	ITD	IDI-006614	109	Perpetuity
8	ROW Observation Wells	BOR	IDI-0008954	4	Perpetuity
9	Emergency Airstrip Lease	Idaho Division of Aeronautics	IDI-0010307	43	03/05/2013
10	Emergency Airstrip Lease	Idaho Division of Aeronautics	IDI-0010310	40	09/19/2013
11	Federal Aid Highway 93	ITD	IDBL-0047476	87	Perpetuity
12	ROW Mineral Material Sites	ITD	IDBL-0047852	156	Perpetuity
13	Federal Aid Highway 93	ITD	IDBL-0049776	373	Perpetuity
14	ROW Mineral Material Site	ITD	IDBL-0052624	40	Perpetuity
15	Federal Aid Highway 93	ITD	IDBL-0052700	141	Perpetuity
16	Federal Aid Highway 93	ITD	IDBL-0053778	28	Perpetuity
17	ROW Mineral Material Sites	ITD	IDBL-0053709	7	Perpetuity



Numbers associated with each feature are a reference to further descriptions found in Table 18 - Valid Existing Rights. No warranty is made by the Bureau of Land Management or National Park Service for use of the data for purposes not intended by these agencies.

FIGURE 20
VALID EXISTING RIGHTS

Craters of the Moon National Monument & Preserve

U.S. Department of the Interior * National Park Service * Bureau of Land Management

The Monument contains three Free Use Permits for pumice/cinders; Butte County and Blaine County use these sites as a material source for gravel road maintenance. Free Use Permits authorize use only by state or local governments. These material sites are not available to the general public or commercial parties.

The amount of suitable road surface material available within the Monument is essentially unlimited. However, Proclamation 7373 and agency policy restricts extraction of mineral materials to valid existing rights and administrative uses only. Cinders are generally considered to be an undesirable material for road maintenance because they are not very durable compared to gravel. Cinders are very light, which reduces transportation costs. High quality crushed gravel is available outside of the Monument, but at a substantially higher cost than the readily available cinders.

ITD also holds three ROW grants for five pumice/cinder material sites in the Monument. These ROWs are valid existing rights unaffected by Proclamation 7373. The former General Land Office granted these ROWs in the 1930s during the construction of US 20/26/93. ITD has used only two of these material sites during the last 10 years.

The Monument contains no known industrial minerals, gems, semiprecious stones, or petrified wood. The collection of any lava rock features in the Monument is authorized only under a scientific collecting permit issued to institutions. Public collecting is illegal. Many public and commercial sources exist throughout southern Idaho for lava-based materials used in landscaping, barbecue grills, and saunas.

SPECIAL DESIGNATION AREAS

Wilderness

Congressional designation of the 43,243-acre Craters of the Moon National Wilderness Area was enacted on October 23, 1970, making the Monument and Petrified Forest National Park the first units within the National Park System with designated wilderness areas (PL 91-504).

The Craters of the Moon Wilderness is south of US 93 entirely within the original Monument (Figure 21). All but the north end of the wilderness boundary is adjacent to lands inventoried by BLM as the Great Rift WSA in 1980 (USDI BLM 1980). When designated, the wilderness boundary was offset one-eighth of a mile (660 feet) inside the Monument boundary. Thus, a narrow non-wilderness strip of the Monument separates the Great Rift WSA and the designated wilderness. This "buffer" area was intended to permit administrative vehicle access for firefighting and other management needs (U.S. House of Representatives 1970). Since the narrow buffer area does not contain roads and consists largely of impassable lava flows, it never has been used for such purposes.

Much of the scenic 7-mile Loop Drive developed by NPS in the 1930s and 1950s lies close to the northern edge of the wilderness area. At two points, the wilderness boundary lies within 2,000 feet of US 20/26/93. The openness of the terrain results in the sights and sounds of traffic on the highway and the 7-mile Loop Drive being perceivable from some of the northernmost areas of the wilderness.

Human-made facilities in the wilderness area are limited to the Wilderness and Tree Molds trails, a small concrete watering trough that predates the Monument, and numerous rock cairns and rock rings of historic or prehistoric origin. Initially developed as a primitive wagon trail to serve pre-1924 livestock use on Little Prairie, the 5.1-mile Wilderness Trail later served as a primitive vehicle route until 1970. At some point, perhaps as early as the 1950s, the route was closed to the public, and only administrative use was permitted. The extent of construction or maintenance on the route up until 1970 is poorly documented, but no evidence of grading exists. There has been no documented maintenance of the route since 1970. The trail to Echo Crater remains distinct, but south of Echo

Crater, the trail has faded in some areas.

Before the wilderness was designated, the 1.5-mile Tree Molds Trail was developed to gain access to numerous tree mold features. The Tree Molds Trail is the only maintained trail listed in the 1996 NPS Wilderness Management Plan (USDI NPS 1996). A spur trail leading from the Tree Molds Trail to Great Owl Cavern was closed following wilderness designation, and a large metal stairway leading into the cavern was removed.

NPS management activities have been limited to monitoring air quality, vegetation, wildlife, and recreational impacts and fire suppression. In 2000, a fire management plan was completed that provided for managing natural fires for resource benefits under certain conditions (USDI NPS 2000a).

Wilderness Study Areas

WSAs are lands identified through the BLM wilderness inventory process as possessing wilderness characteristics (defined by the Wilderness Act of September 3, 1964, 16 USC 1131). WSA lands are designated in BLM land use plans and managed under the BLM Interim Management Policy (IMP) for Lands Under Wilderness Review, Handbook H8550-1, so as not to impair their suitability for wilderness designation (USDI BLM 1995).

Four WSAs have been designated within the boundaries of the Monument (Table 24, Figure 21). Eighty-four percent of the WSAs lie within the National Preserve; the rest is managed by BLM. The 381,800-acre Great Rift WSA was designated in 1980 (USDI BLM 1980). The Great Rift WSA encompasses most of the Craters of the Moon and Wapi lava fields, along with parts of the surrounding sagebrush grasslands. The Raven's Eye WSA covers 68,300 acres of the western part of the Craters of the Moon Lava Field, with 66 percent of the area within the Monument. The Little Deer WSA takes in 35,200 acres of a narrow extension of the Craters of the Moon Lava Field and adjacent sagebrush grasslands. The 9,700-acre Bear's Den Butte WSA is centered on a narrow finger of the Craters of the Moon Lava Field, which extends into Laidlaw Park. The Raven's Eye, Little Deer, and Bear's Den Butte WSAs were designated in 1986 (USDI BLM 1987).

BLM land use plans indicated that parts of the WSA were suitable for preservation as wilderness. Designation of the WSA as wilderness requires a recommendation by the President and an Act of Congress. The lands remain in WSA status until Congress acts either to designate the land as wilderness or to release it for other uses. In 1985, President Reagan recommended that Congress designate 322,450 acres of the Great Rift WSA as wilderness (Reagan 1985).

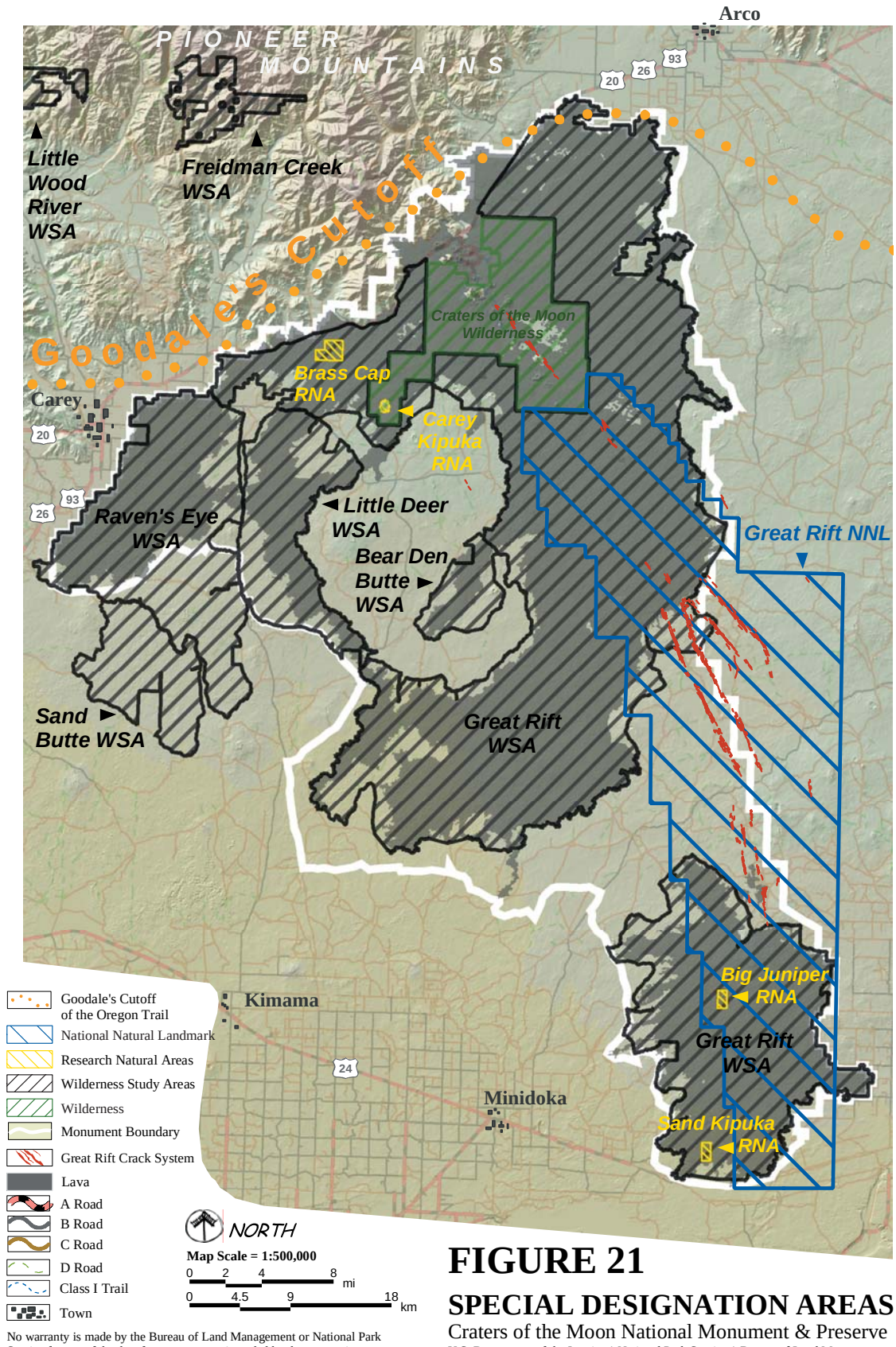
Presidential Proclamation 7373 transferred portions of the four WSA to NPS in 2000. The proclamation directed the following:

Wilderness Study Areas included in the Monument will continue to be managed under Section 603(c) of the Federal Land Policy and Management Act of 1976 (43 USC 17011782).

Section 603(c) requires that WSAs be managed to maintain their suitability for wilderness designation and prevent unnecessary or undue degradation. The BLM and NPS will follow the BLM WSA IMP in guiding management decisions within the WSA until completion of this Plan/EIS (USDI BLM/NPS 2001).

There are no roads within the WSA boundaries. BLM wilderness inventory procedures (USDI BLM 2001) define roads as routes improved and maintained by mechanical means to ensure relatively regular and continuous use. A route maintained solely by the passage of vehicles is defined as a vehicle way. Numerous vehicle ways exist within the WSA. The BLM IMP for WSAs permit continued motorized travel on those ways recorded during the wilderness inventory. Additional vehicle routes created since the inventory were not authorized, and motorized vehicle use of such routes is prohibited.

Wilderness inventories recorded 20 miles of vehicle ways in the Raven's Eye WSA, 5.1 miles in the Little Deer WSA, and 2 miles in the Bear Den Butte WSA (USDI BLM 1987). Current inventories of the Great Rift WSA indicate that it contains approximately 29



No warranty is made by the Bureau of Land Management or National Park Service for use of the data for purposes not intended by these agencies.

FIGURE 21

SPECIAL DESIGNATION AREAS

Craters of the Moon National Monument & Preserve

U.S. Department of the Interior * National Park Service * Bureau of Land Management

miles of vehicle ways (Class D roads). Unauthorized vehicle ways may have been created since the inventories were completed, but the numbers are unknown. New vehicle ways may have also been created during authorized fire suppression and restoration activities.

Other human-made facilities in the WSAs include wildlife guzzlers, sheep bed grounds, fences, and watering structures associated with livestock use. The sights and sounds of roads adjacent to the WSAs are visible and audible from within limited portions of the WSAs. Communication towers near Arco and Lava Lake are visible from portions of the Great Rift WSA.

Research Natural Areas, National Natural Landmark, Areas of Critical Environmental Concern

- **Research Natural Areas**
  NPS policies define RNAs as areas with prime examples of natural ecosystems or significant genetic resources with value for long-term research. Activities within RNAs are restricted to non-manipulative research, education, and other activities that will not detract from the area's research value.

  Four RNAs have been designated within the Monument: Carey Kipuka RNA, Big Juniper Kipuka RNA, Brass Cap RNA, and Sand Kipuka RNA. Three of the four were nominated and designated by BLM before 1991 (Hilty and Moseley 1991). The fourth, Carey Kipuka, was nominated and designated by NPS in 1993. All four RNAs feature kipukas, an area of older vegetated landscape surrounded by recent lava flows. Isolation, difficulty of access, and a lack of surface water made these areas unsuitable for livestock, and little or no grazing has been recorded. Isolation has also limited recreational access to the kipukas.

  Carey Kipuka RNA is a 170-acre kipuka in the Craters of the Moon Lava Field, 14 miles east of Carey, Idaho. The kipuka and surrounding area was added to the Monument in 1961 and became designated wilderness in 1970. The area has also been nominated as a National Natural Landmark (NNL).

  The entire kipuka is dominated by sagebrush vegetation represented by three distinct vegetative communities. The area is a particularly good representative of the Low Sagebrush Theme, Low Sagebrush/ Idaho Fescue Subtheme. Cheatgrass (Bromus tectorum), an aggressive invader of areas disturbed by fire, is widespread throughout much of the kipuka. No other invasive exotic plants or noxious weeds have been recorded. Scientific investigation of the area dates to 1956, and its value for basic and applied study of sagebrush-grassland ecosystems has long been recognized (Tisdale 1965). Long-term

Table 24
Summary of Wilderness Study Areas

WILDERNESS STUDY AREA	AREA WITHIN MONUMENT (ACRES)	NPS AREA (ACRES)	BLM AREA (ACRES)	TOTAL WSA AREA (ACRES)	AREA WITHIN MONUMENT RECOMMENDED SUITABLE BY BLM (ACRES)
Great Rift	381,100	335,000	46,000	381,800	322,450
Raven's Eye	45,400	37,000	8,400	68,300	67,110
Little Deer	35,100	21,300	13,800	35,200	0
Bear Den Butte	9,700	4,300	5,400	9,700	0

**** Acreage values have been rounded to the nearest hundred acres.***

monitoring of vegetation and breeding birds in the area continues to be conducted by NPS.

Big Juniper Kipuka RNA is a 320-acre area within the Wapi Lava Field, 14 miles northeast of Minidoka, Idaho. This RNA contains undisturbed examples of several habitat types that occur on the ESRP, including Wyoming big sagebrush/bluebunch wheatgrass, Wyoming big sagebrush/Thurber's needlegrass, and threetip sagebrush/bluebunch wheatgrass. Surrounding lavas contain a sparse cover of Utah juniper woodland with a mixed shrub later (Caicco and Wellner 1983b).

Brass Cap Kipuka RNA is an 860-acre area surrounding the Brass Cap Kipuka on the Craters of the Moon Lava Field, 11 miles east of Carey, Idaho. This area is an undisturbed example of a major habitat type. Alkali sagebrush and Idaho fescue are the dominant species, covering nearly 100 acres of the kipuka (Caicco and Wellner 1983a).

Sand Kipuka RNA is a 320-acre area surrounding Sand Kipuka, 12 miles east of Minidoka within the Wapi Lava Field. The kipuka is dominated by Wyoming big sagebrush or basin big sagebrush and needle-and-thread grass. Utah juniper woodlands are well developed on the lava surfaces surrounding the kipuka (Wellner and Moseley 1983).

- **National Natural Landmarks**
  NNLs are areas of national significant designated by the Secretary of the Interior as being outstanding representatives of a region's biotic or geologic features (U.S. Government Printing Office 2001). The Monument encompasses most of the 252,000-acre Great Rift NNL, which was designated by the Secretary of the Interior in 1968 for its geological significance and enlarged in 1980 in recognition of its biological significance.

  The low sagebrush/Idaho fescue habitat of the north unit and the early low sagebrush/Idaho fescue habitat in Carey Kipuka have been evaluated and found to meet the criteria for NNL status. They are outstanding representatives of the Low Sagebrush/Idaho Fescue Subtheme in the Low Sagebrush Theme within the Columbia Plateau Natural Region (Rust 2002). Part of the north unit of the proposed NNL extends outside of the Monument onto BLM lands.

- **Areas of Critical Environmental Concern**
  ACECs are certain areas designated by BLM because of their unique or significant environmental qualities or features. The three RNAs (Old Juniper Kipuka, Sand Kipuka, and Brass Cap Kipuka) in the National Preserve were BLM ACECs before the Monument was expanded. The BLM Baker Cave ACEC was also transferred to the NPS by the proclamation and will continue to be managed for its cultural resource values. The Laidlaw Park area would be considered for ACEC designation under Alternative C (see Appendix G, Proposed Laidlaw Park ACEC evaluation).

VISITOR EXPERIENCE

INTERPRETATION/ VISITOR UNDERSTANDING

Through interpretive and educational programs, NPS and BLM strive to instill in visitors an understanding, appreciation, and enjoyment of the significance of the Monument. Interpretive and educational programs encourage the development of a personal stewardship ethic and broaden public support for preserving our nation's natural and cultural resources.

The interpretive program at the Monument focuses on providing an educational experience to the widest possible variety of visitors. Major target audiences are summer visitors, school students, visitors from

local communities, and winter visitors. Other groups are backcountry travelers, hunters, and people planning visits to the Monument. Programs to best meet the needs of these groups are regularly scheduled walks and talks during summer; school group orientations and teacher workshops in spring and fall; special topic weekend programs; and winter ecology workshops.

Informational kiosks, press releases, and the development of Web sites have been implemented recently to address the needs of more users. Visitors unable to attend or take advantage of these activities have an excellent opportunity to learn about the Monument through a broad range of educational opportunities, including a museum, wayside exhibits, self-guided trails, and publications.

Interpretive themes are important ideas, stories, and concepts that are presented to visitors in exhibits, publications, and programs. With the development of a Comprehensive Interpretative Plan for the Monument, the following themes will be addressed:

- An extraordinary example of the creation of a volcanic landscape.
- A place with a diverse population of plants and animals associated with a wide variety of volcanic habitats.
- A resource associated with thousands of years of human history, giving insight into a variety of people, cultures, and times.
- A laboratory that supports a diverse natural and cultural history, which provides important opportunities for research and education.
- A landscape of lava and sagebrush — one of the few remaining examples of what is "natural."

The primary theme of the interpretive program at the Monument is the significance of the awesome effects of volcanism on this landscape. Other themes stress the incredible diversity of plants and animals that have adapted to this harsh environment and the unique cultural history that reflects the interactions between people and the rugged volcanic terrain. An ongoing effort to make visitors aware of their relationship to this environment and their role in preserving and protecting this area is also an integral component of all interpretive activities. Visitor safety, orientation, and trip-planning information are available through a variety of media. See the "Social and Economic Conditions" section for more information about public health and safety, including visitor health and safety.

Making visitors aware of the need to avoid certain behaviors that may have a detrimental impact on Monument resources is the first step in the protection of fragile natural and cultural features. The need for visitors to stay on trails, avoid walking in sensitive areas, and leaving the rocks in place is stressed. This approach is believed to have a positive effect in protecting such features as spatter cones, cinder cones, and ropy lava flows. The need to protect plants, animals, and archaeological and historic sites is also a part of a diverse interpretive program.

A visitor survey done at the Monument in 1989 indicates that interpretive programs were considered important by at least 74 percent of Monument visitors (Machlis et al. 1989). More specifically, the percentage of those visitors using non-personal services such as NPS folder and map (91 percent), wayside exhibits (58 percent), self-guided trails (75 percent), and Visitor Center exhibits (77 percent) indicates wide use among visitors (Machlis et al. 1989). The percentage of all visitors using personal services such as evening programs (10 percent) and guided walks (17 percent) indicates that a much smaller number of visitors attend these types of programs. Such visitor statistical information is not available on the expanded part of the Monument.

Nearly all interpretive efforts take place in the developed section of the Monument adjacent to US 20/26/93. Along what is known as the 7-mile Loop Drive, visitors have access to a visitor center with accompanying exhibits and audiovisual programs, a series of self-guided trails, and a system of wayside exhibits at roadside pullouts and along several trails. Interpretive walks and activities, available primarily during the peak season, are also conducted from

this site. Although not all interpretive activities or sites are considered accessible to all visitors, a few recently developed sites offer a higher level of access.

The Monument's interpretive facilities are in good to excellent condition. Visitor Center exhibits done in the 1950s have been completely redone in recent years. A few wayside exhibits are dated, but most have been installed within the past 15 years.

The interpretive program also has several other components, including publications, educational programs, winter ecology walks, a Junior Ranger Program, and off-site programs that offer interpretive opportunities to a much larger, diverse audience. Both the NPS and BLM Web sites contain information about the Monument.

Interpretation in the recently expanded Monument is limited, consisting primarily of informational signs at key attractions like Crystal Ice Cave, Kings Bowl, Baker Caves, and Bear Trap Cave. A detailed map of the area published several years ago offers orientation and interpretation. A series of signs is being developed for use in the Kings Bowl/Crystal Ice Cave area to convey critical safety messages and site information. This project, which predates the Monument expansion, is being carried out in connection with the rehabilitation of a defunct commercial operation site that left behind numerous deteriorating structures and unsafe conditions.

Kiosks containing orientation, safety, and user information have been installed at key access points. An extensive self-guiding trail system has been developed at Hell's Half Acre on I-15, which, although not in the Monument, interprets many related subjects.

RECREATION AND PUBLIC SAFETY

General Visitation

Visitation to the original Monument averages 200,000 people per year, with peak visitation on summer weekends. Many visitors are on vacations that include Yellowstone and Grand Teton National Parks to the east and Sun Valley and the Sawtooth National Recreation Area to the west (USDI NPS 1990). Table 25 presents visitation statistics for the original Monument for 1990 through 2001, and Appendix H presents various recreational statistics for 1999 to 2002.

Table 25
Visitation at the NPS
Craters of the Moon
National Monument 1990-2001

YEAR	TOTAL VISITS *	PERCENT CHANGE
2001	186,993	-14.31%
2000	213,758	0.86%
1999	211,929	7.83%
1998	195,328	-10.66%
1997	216,145	-0.44%
1996	217,087	-9.09%
1995	236,827	2.28%
1994	231,427	-1.99%
1993	236,027	-2.17%
1992	241,160	9.60%
1991	218,000	5.50%
1990	206,000	-

Total visits are the total of recreation and non-visits.

To view a detailed breakdown, visit the Public Use Statistics Office Web site.

Commonly, visitors spend less than 3 hours at the Monument; 5 percent remain overnight. The typical visitor will stop and tour the Visitor Center, then sight-see along the 7-mile paved loop drive, taking advantage of photographic opportunities and often having a picnic before leaving.

Within the original Monument, nearly 80 percent of visitors are in family groups, with the most common

Visitor Center

visitors in age groups over 62 and under 11. For nearly 80 percent of visitors, this is their first visit to Craters of the Moon, and 19 percent of all visitors in the 1988 survey were from foreign countries. Most U.S. visitors originated from the states around the Monument – Idaho, Wyoming, California, Colorado, Oregon, and Washington (Machlis et al. 1989).

School groups represent an important visitor group. More than 100 school groups comprising more than 3,000 students visit the Monument each year. Teachers who have attended one of the Monument-provided teacher orientation workshops lead many of these groups.

Commercial tours also come to the Monument through the primary visitation season. Commercial tour numbers vary from year to year, but the average is between 30 and 40 tour buses each year.

Winter visitation is low, but winter attracts local and regional visitors familiar with the quality cross-country skiing and snowshoeing opportunities. The Loop Drive is closed to vehicle traffic and groomed for skiing in winter. The NPS has also offered winter ecology programs for the past few years; these are always well attended.

Visitation to the expanded parts of the Monument over the last 10 years averages approximately 20,000 visits per year, according to BLM's Recreation Management Information System (RMIS). Some popular sites are Pillar Butte, Wood Road Kipuka, Bear Park, Snowdrift Crater, Kings Bowl, and Bear Trap Cave. No visitor facilities are available at any of the sites, but all receive day use and occasional overnight camping. Recreational activities in the expanded part of the Monument, in order of popularity, are hunting; driving for pleasure; geologic exploration including caving, lava hiking, and sightseeing; hiking; primitive camping; photography; horseback riding; and mountain biking.

Commercial Outfitters and Guide Services

There is currently one temporary special use permit issued for guided tours within the Monument. In 2004, there were no tours conducted under this permit and past use has been minimal. There are two existing hunting outfitter permits issued for Hunting Units 52A and 68 (one in each unit) within the Monument, but past use of these permits has been quite low as well. While some interest in commercial outfitter and guide permits has been expressed, the agencies do not foresee a dramatic increase in demand for these permits over the life of the plan.

Hunting

The Idaho Fish and Game Commission sets hunting seasons and other regulations for hunting in Idaho. Most of the Monument and Preserve is within Idaho Fish and Game Hunting Unit 52A (Figure 22). The southern part of the area, including all of the Wapi Lava Field, is included in Unit 68. A very small portion of the northern edge of the Monument and Preserve fall within Units 49 and 50. The length of season and number of available controlled-hunt tags vary annually on the basis of wildlife population levels and other factors.

RMIS and IDFG estimates indicate that sage-grouse hunting and open mule deer hunting attract the highest number of hunters in the Monument. The open seasons for archery (antelope, elk, and deer), other small game (rabbits, upland birds), predators, and unprotected species, along with the controlled seasons (draw tags) for antelope, elk, and deer, account for a much smaller portion of hunting use.

Almost all hunting has historically been in the BLM portions of the Monument. A very small amount of

Cross-country skiing in the Monument

hunting occurs in what is now the NPS Preserve. The exposed lava flows in the NPS Preserve can be used for a quality hunt for a few hunters who seek the challenge. Hunting has never been authorized in the original NPS Monument.

The very small amount of hunting by members of the Shoshone-Bannock Tribes that takes place in the Monument is considered a treaty right and is not considered a recreational hunting experience.

Motorized and Mechanized Recreation
OHV use in the Monument includes off-highway motorcycles, all-terrain vehicles (ATVs), and snowmobiles. Most OHV use in the Monument takes place during hunting seasons or in association with other land uses like livestock operations. The amount of OHV-specific recreation activity in the Monument is quite small (RMIS estimates less than 5,000 visits per year). Most OHV activity takes place on the existing road network, since no trails have been designated for motorized use.

A small amount of mountain biking takes place in the expanded part of the Monument. This small but growing recreational use is confined primarily to the existing road network, because no designated trails for mountain biking exist. In the area of the original Monument, mountain bike permits are available for riding along portions of Goodale's Cutoff. Bicycle use occurs on the 7-mile Loop Drive and other areas. No OHV use is permitted within the original Monument.

Hiking and Horseback Riding
Most hikers hike on designated trails in the original Monument. Hiking trails to features of interest in the original Monument are the North Crater Flow, Devils Orchard, Inferno Cone, the Big Craters/Spatter Cones area, Tree Molds, and the Cave Area. Hikers in the non-Wilderness part of the original Monument regularly see other visitors, because the area is highly used. Opportunities for solitude are limited; however, the Craters of the Moon Wilderness offers outstanding opportunities for self-directed hiking, with an excellent chance to experience solitude.

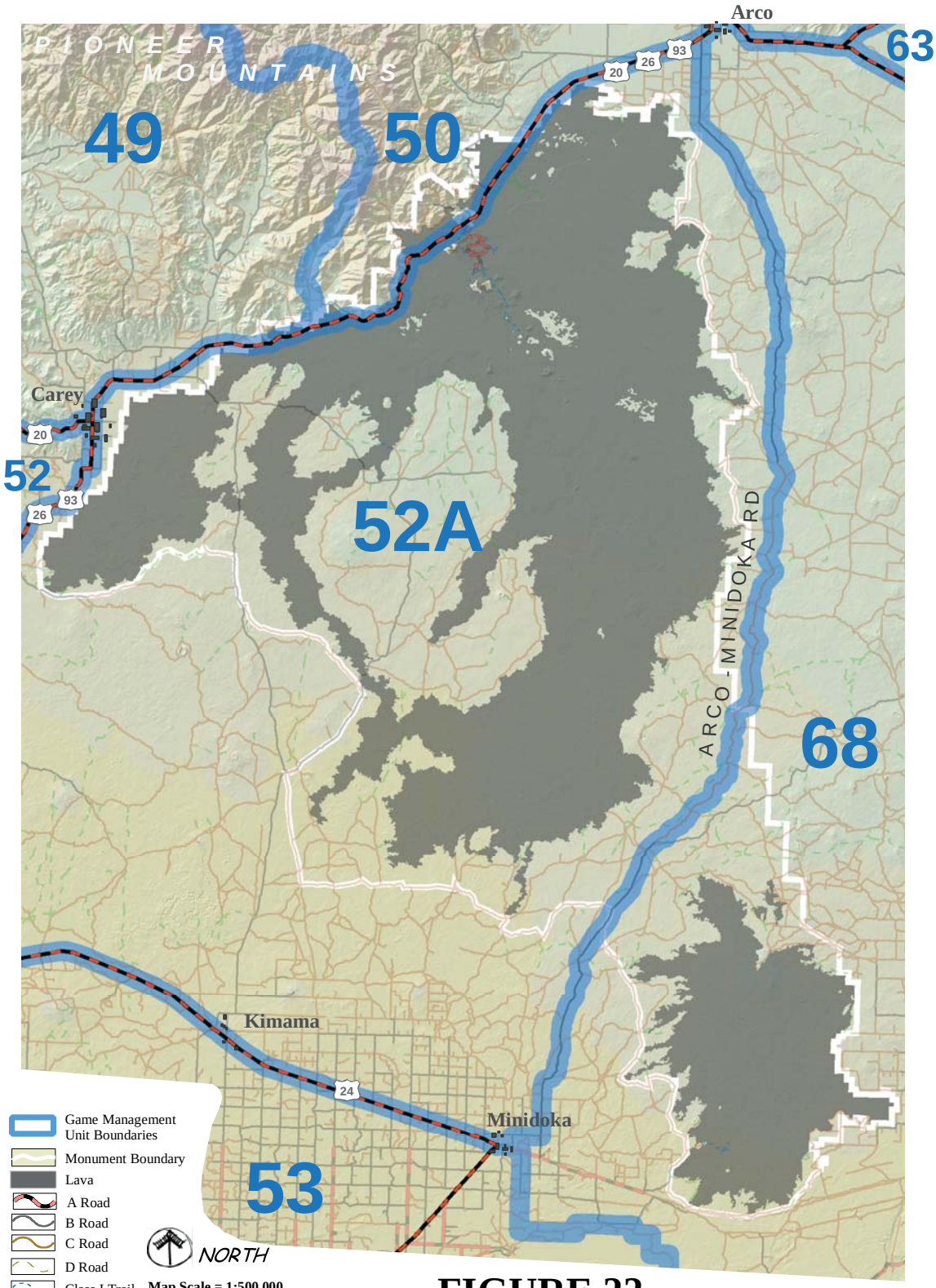
Wilderness use is extremely light, with an average of 130 overnight backpackers per year (based on backcountry permits issued 1990 through 2002). Backpacking parties usually consist of fewer than four persons, and they seldom stay out more than two nights (USDI NPS 1990). All water must be packed into the backcountry. Exact numbers of day users are unavailable.

Hiking in the expanded part of the Monument offers outstanding opportunities to experience a high degree of solitude. Since no designated hiking trails exist within the expanded portion of the Monument, most hiking experiences are cross-country and self-directed. Some constructed hiking trails exist at the Crystal Ice Caves/ Kings Bowl area (RMIS estimates 1,000 visits).

Horseback riding in the original Monument is limited to the Craters of the Moon Wilderness Trail by permit only. In the expanded part of the Monument, most stock animals and horseback riders work in association with livestock operations and in other non-recreation activities, but there is a small amount of recreational horseback riding and pack-stock use in this area. Hunters also regularly use horses. The few recreational users enjoy outstanding opportunities for solitude and a self-directed experience. Riders and pack-stock users travel cross-country or along the existing road network. No designated trails currently exist for horseback riding.

Camping
In the original Monument, 51 developed campsites with water, restrooms, charcoal grills, and picnic tables are available on a first-come-first-serve basis. Most campers stay only one night and are usually gone by 10 a.m. The campground is rarely full, with the exception of several weekends during the summer season, generally around holidays.

Recreational overnight use of the Wilderness area is light. The NPS issues fewer than 100 overnight camping permits per year in the Wilderness. The entire area is snow-covered and accessible by snowshoe and ski for at least one-third of the year. Most overnight Wilderness users hike the Wilder-



Game Managment Unit data provided by Idaho Fish & Game. No warranty is made by the Bureau of Land Management or National Park Service for use of the data for purposes not intended by these agencies.

FIGURE 22
GAME MANAGEMENT UNITS
Craters of the Moon National Monument & Preserve
U.S. Department of the Interior * National Park Service * Bureau of Land Management

Hiking in Craters of the Moon National Monument

ness Trail and camp in or near Echo Crater. Stock use is restricted to day use by groups of 12 or less on the Wilderness Trail. No overnight camping with stock is permitted (USDI NPS 2002b).

The expanded part of the Monument does not contain any developed campgrounds. Currently, dispersed camping is available throughout the entire expanded portion. Many use-established primitive campsites near crossroads, access points, and major features of interest are available throughout the Monument.

Caving

Caving does not draw large numbers of visitors; however, caving is an important and unique recreation opportunity at Craters of the Moon National Monument. Opportunities exist for recreational cave experiences ranging from hiking a paved trail to an easily accessible lava tube such as Indian Tunnel, to visiting a remote wild cave somewhere in the expanded portion of the Monument, to the potential to actually discover a previously unknown cave.

Monument caves differ from limestone caves in that they are lava tubes once formed by flowing lava. Although they exhibit flowstones and other speleothem and erosion features, those features are primarily associated with volcanism and lava transport.

Many easily accessible caves in the area have been known locally for a long and are frequently visited. Over time, some caves show signs of irresponsible use such as graffiti and vandalism, which can detract from the caving experience.

Cave exploration, discovery, survey, and mapping are important activities for local caving organizations. The local and regional chapters (Grottos) of the National Speleological Society play an important role in conserving the cave recreation resource. The groups engage in cleanup projects and other cave conservation activities, in addition to mapping, surveying, exploring, and educating users about caves and cave conservation.

Most caves do not appear on maps but can be explored upon discovery. Other caves require a permit for access. Some cave locations that appear on maps are the 15-mile-long Bear Trap Lava Tube along the Arco-Minidoka Road and the Lariat Cave near Kings Bowl.

Recreational camping in Cinder Butte

The best-known cave in the region is Crystal Ice Cave, which is a fissure cave rather than a lava tube cave. In 1964 a concessionaire, under permit from the Idaho Falls BLM District Office, developed the cave. When the cave was open, annual visitation was 5,000 to 10,000 people. Improvements at the cave included buildings, restrooms, and trails. Generators provided electricity to light the cave and run a refrigeration unit used to maintain the ice formations. Prompted by safety concerns and vandalism, BLM removed most outside facilities and signs, sealed the tunnel doors, and installed signs to inform the public of safety concerns entering the cave.

Health and Safety
Several factors are involved in health and safety concerns for Monument visitors and surrounding communities. These are discussed below.

- **Access in and Near the Monument**
  The Monument contains several hundred miles of roads of various qualities and levels of maintenance. Most of these roads and ways are not maintained at all. In addition to different types of roads, road conditions vary seasonally from impassable snow in winter to deep-rutted mud in spring and late autumn to dry and very dusty in summer. Nearly all the roads in the interior of the Monument require a high-clearance four-wheel drive vehicle equipped with good tires. At any time of year, rain can render the roads impassable to any vehicle.

  Due to the size of the Monument and the complexity of the road system, navigation can be confusing. The BLM maintains a limited system of directional signs on the Monument; however, many roads and ways are not signed, making map-based navigation difficult. It is recommended that travelers in unfamiliar parts of the Monument use a good map and use automobile odometers to count mileage from landmark to landmark. The iron-rich nature of the lava and rocks underlying the sagebrush steppe of the Monument can cause compasses to give incorrect readings by as much as 40 degrees.

  In many remote areas of the Monument, emergency services can be anywhere from hours to days away. It is advisable to carry a reliable form of emergency communication in these areas at all times.

  Two main roads bisect the Monument, and a U.S. highway runs along its northern border. The Arco-Minidoka Road starts near the town of Arco, on the north side of the Monument, and runs to Minidoka on the south side. Farther to the west, the Carey-Kimama Desert Road connects the town of Carey, along US 93 to SH 24 on the south end of the Monument near the town of Kimama. US 20/26/93 runs along the northern edge of the Monument.

- **Weather**
  South Central Idaho and the Monument experience various degrees and extremes of weather for all four seasons. Winter can bring high winds, subzero temperatures, and deep snow. Generally, the undeveloped portions of the Monument are inaccessible during winter to all but snowmobile and ski/snowshoe travel, and cross-country travel over lava fields in winter is discouraged for safety reasons. It is inadvisable to drive a wheeled vehicle in the Monument in winter because deep snow and fast-changing weather conditions can leave travelers stranded.

  In spring, high winds, cold temperatures, rain, and thunderstorms can present safety hazards to Monument visitors. A sudden rain at any time of year can render the roads impassable to vehicles outside the Frontcountry Zone. In contrast, summer months can be very hot and dry. The average annual rainfall in south-central Idaho is below 14 inches, and it is not uncommon for areas of the Monument area to receive no rainfall at all in summer. The temperatures are typically dangerously hot, often exceeding 100 degrees Fahrenheit for days or weeks on end.

  Visitors to areas outside the Frontcountry Zone are advised to come prepared for extreme hot weather and carry the necessary general and emergency supplies, including plenty of water, extra vehicle fuel, a first aid kit, food, navigation equipment such as maps, compasses, and Global Positioning System (GPS) units, and a reliable form of communication. Because there are few, if any, sources of potable water in the Monument, all water must be carried in. Livestock well water is usually not safe to drink. Dehydration from

exposure to extreme desert conditions is a serious hazard in the Monument.

- **Caves, Fissures, and Lava**
  Both the open lava areas and the sagebrush steppe of the Monument area contain lava tube-type caves. These caves range in size and complexity from small rock shelters to several-miles-long convoluted tube systems with ice formations and steep vertical drops. People who want to enter and explore caves should be experienced and familiar with all the provisions and contingencies of safe caving, and they should follow the Monument's cave plan.

  Along the Great Rift are many open cracks and fissures, which can expose vertical drops varying from a few feet to an unknown depth. The basalt rock, of which these features are composed, is notoriously friable and can collapse without warning, leading to a serious or deadly fall.

  Exposed lava features in the Monument are very rough and difficult to traverse, and in summer the surface temperatures of the lavas can reach 140 degrees Fahrenheit. Hiking over lava surfaces, particularly a'a flows, can be arduous and can present tripping, falling, and joint-twisting hazards. Long hikes over the lava can result in fatigue, dehydration, and disorientation. People hiking on the lava are advised to wear sturdy boots, protective gloves, and carry plenty of water and a reliable emergency form of communication.

- **Wildfire**
  During the annual wildfire season, approximately late-June through September, the Monument area receives little or no rainfall. Very dry vegetation and high wind contribute to hot, fast-moving wildfires that can present serious safety hazards to visitors and surrounding communities. Wildfires are primarily confined to the sagebrush steppe of the Monument. However, at times wildfire can "creep" through colonizing vegetation on the exposed lava flows. Visitors should familiarize themselves with the fire danger level and any warnings or restrictions currently in place.

  It is also very easy to start a wildfire on the Monument through the careless use of fire, smoking materials, and many other means. Fires are often started by the catalytic converter on vehicles coming into contact with dry vegetation.

- **Livestock**
  Many areas of the sagebrush steppe in the Monument are in cattle and sheep livestock use allotments. While generally not aggressive, cattle and sheep can be unpredictable and present a safety hazard to visitors. Sheepherders often keep large sheep-guarding dogs with their bands of sheep. These animals are not human-friendly and may have little or no experience with humans or being treated as pets. Often, these dogs are left alone to tend a sheep band, and their only duty is to chase off or kill anything they deem to be a threat to the sheep. Visitors are advised to avoid these dogs and to prevent their pets from venturing near sheep-guarding dogs or the sheep.

- **Snakes**
  Rattlesnakes inhabit the Monument area and are usually active between mid-spring and late-fall. They are most commonly found on the sagebrush steppe, but they can also be found on the open lava. They often hide near cave entrances where there is shade and cool temperatures, which attract prey species. They represent a serious safety issue in that any rattlesnake bite should be treated as an emergency.

VISUAL RESOURCES

Viewscape

Perpetuating scenic vistas and open western landscapes for future generations is one of the purposes identified for the Monument. The visual resources of the Monument represent a remnant of the undeveloped American West and one of the few remaining great expanses of sagebrush steppe. The contrasting lava flows were described in the in 1924 Presidential Proclamation originally establishing the Monument as a "weird lunar landscape ... peculiar to itself." This creates a viewscape unique in North America.

The gray-green sagebrush steppe and black lava fields ride up against the high Pioneer Mountains to the north. Across the Monument, 3,500 feet of vertical relief present visitors with enormous panoramic views to the south. On a clear day, the Grand Tetons, 140 miles to the east, can be seen from the Monument. One of the nation's clearest airsheds enhances these long, uninterrupted vistas.

The Monument contains numerous striking volcanic features such as pahoehoe and a'a lava flows, cinder cones, spatter ramparts, and enormous lava fields. Low shield volcanoes and cinder cones (known locally as "buttes") rise up throughout the entire Monument landscape. The exposed lava varies in color, while shapes and textures of the flows add scenic variety on a smaller scale. Nearly barren of vegetation, the most recent lavas at times flowed around kipukas, which offer some visual relief from the continuous lava. Expansive sagebrush steppe and grasslands, as well as the different ages and types of lava surfaces, support a remarkable variety of plant and animal communities that add to the visual diversity of the Monument.

Visual Resource Management

Visual Resource Management (VRM) is a standard tool used by the BLM to identify and protect visual values on public lands (8400-Visual Resource Handbook and Manual Series). A VRM inventory of the Monument area was completed in 1989, including an evaluation of scenic quality, identification of viewsheds, and key observation points for visitors. This inventory data was analyzed and presented as visual resource classes. This Plan/EIS places all public land into one of four VRM management classes. VRM classes provide standards for planning, designing, and evaluating future management projects.

The four VRM management class designations are as follows:

- Class I – The objective of this class is to preserve the existing character of the landscape. Any contrast created within the characteristic landscape must not attract attention. This classification is applied to Visual ACECs, wilderness and WSAs, Wild and Scenic Rivers, and other similar situations.
- Class II – The objective of this class is to retain the existing character of the landscape. Changes in any of the basic visual elements caused by management activity should not be evident in the landscape. A contrast may be seen but should not attract attention.
- Class III – The objective of this class is to partially retain the existing character of the landscape. Contrasts to the basic elements caused by a management activity may be evident and begin to attract attention in the landscape. The changes, however, should remain subordinate in the existing landscape.
- Class IV – The objective of this class is to provide for management activities that require major modification of the existing character of the landscape. Contrasts may attract attention and be a dominant feature in the landscape in terms of scale. However, the change should repeat the basic element of the landscape.

Night Sky

Night sky is considered an important resource within the Monument. The night sky at the Monument is generally free of artificial light sources and related light pollution. As with daytime viewing of expansive vistas, one of the nation's clearest airsheds creates conditions favorable for stargazing. Astronomy groups have been coming to the Monument for many years to take advantage of dark night skies.

SOUNDSCAPE

Natural Quiet

The Monument is a quiet place. "Natural quiet" refers to the state of having only natural sources of sound; for example, wind, rustling leaves, water, and animal calls. Most of the Monument is not subject to many modern sources of unnatural sound intrusion, or noise. The only major noise producers are highway traffic from outside the Monument, the railroad near the southern edge of the Monument, and aircraft over flights.

The area around the Visitor Center and the campground is adjacent to US 93 and subject to highway noise. Occasional noise from OHVs, ATVs, snowmobiles, and other vehicles occurs in the road portions of the expanded Monument. These noise intrusions are most prevalent during high-use periods, such as hunting season, and least prevalent during low-use periods, such as during winter.

Aircraft over flights create a small amount of unnatural sound intrusion year-round. The Federal Aviation Administration (FAA) has established an advisory ceiling of 2,000 feet above ground level over the Craters of the Moon Wilderness Area. Nonetheless, many over flights occur above 2,000 feet, including commercial aircraft from the airports in Idaho Falls and Hailey, Idaho. There are also small airports in Arco, Picabo, and Burley that support smaller private aircraft that may operate over the Monument. Perhaps the noisiest aircraft over flights are associated with the two military flight-training corridors that cross the Monument.

Helicopter use associated with public land management activities such as wildlife population inventories, livestock monitoring, and firefighting also contribute a small amount of noise. The two emergency airstrips in the Monument receive no regular use.

SOCIAL AND ECONOMIC CONDITIONS

Economic Change in the Planning Area

A look at economic change in each of the five counties within the planning area shows that the economies of even adjacent counties can be very different. While some typify changes that are occurring in many areas of the western United States, others retain high levels of more traditional economic sectors or reflect unique histories. Blaine and Minidoka Counties, for example, follow widespread patterns of economic change in that the services and professional and non-labor income (income derived from investments, retirement, social security, etc.) categories have shown the most significant growth. Despite this similarity, these two counties are at the high (Blaine) and low (Minidoka) ends of the spectrum in terms of per capita income, housing values, and educational attainment.

Lincoln County has also experienced strong growth in the non-labor income and services and professional sectors, although government and agriculture continue to be key elements of the county's economy. Power and Butte Counties are unusual in their dependence on a single employer – in the case of Power County, the American Falls Electrical Generating Station, and in Butte County, the Idaho National Engineering and Environmental Laboratory (INEEL). Both per capita income and average earnings per job in Power County are declining. Despite the relatively high wages paid by INEEL, few employees actually live in Butte County, which decreases the amount of income and spending that remain in the local economy.

This section will discuss changes in sectors known to be directly impacted by tourism in general and the Monument in particular, such as recreation and accommodation. It will also take a broader perspective in considering the Monument an important element of enhancing the setting that helps communities to retain long-term residents and businesses and to attract new ones.

Growth in the services and professional and non-labor income sectors has particularly important bearing on the management of public lands. Although the services and professional sector includes relatively low-paying jobs associated with tourism-based economies, such as hotel maids and

restaurant workers, it also includes small business owners and entrepreneurs, who generate most of the economic growth in the western United States. This group usually has choices about where it will locate, and natural amenities and protected areas are known to draw them to particular areas. This seems to be the case in Blaine County and in other parts of the study area to varying degrees.

Non-labor income is another key element of economic growth in the western United States. Those who contribute the most non-labor income in the forms of investment income, retirement, social security, etc. are another group that has flexibility in where to locate, since they tend not to be tied to particular employers. While many are drawn to scenic areas, they are also looking for the affordable housing and the slower pace of life offered by smaller towns such as those in the planning area.

Local economic changes are closely linked to the area's natural amenities and protected areas, such as Craters of the Moon National Monument, as well as other factors. As is the case across the western United States, the counties and communities in the planning area that are experiencing the greatest economic prosperity are those like Blaine County. In addition to the ski areas and mountain scenery, it has a diverse mix of businesses, a well-educated population with many newcomers who have moved in within the past decade, an easily accessible airport in Hailey, and fairly easy access from the more populous areas of Idaho. Counties that are less prosperous, such as Lincoln County, are more reliant on traditional industries, are relatively isolated from larger population centers by long drives and the lack of an airport, and have less well-educated populations comprised largely of long-time residents.

Direct Monument Economic Impacts

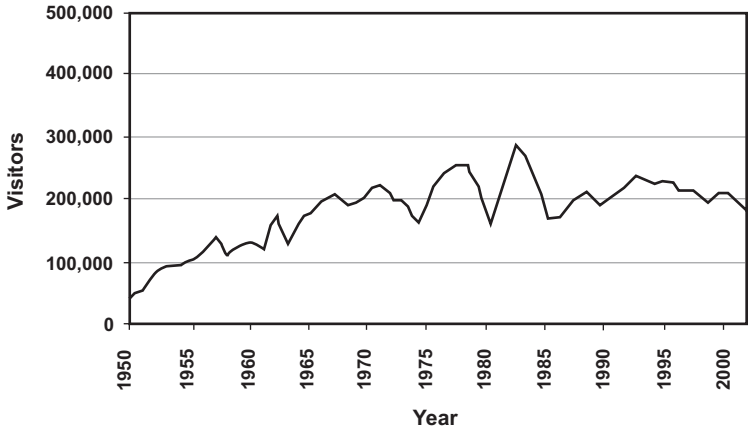
The Monument contributes to the local economy through its employment of 15 part- or full-time workers and approximately 10 to 20 seasonal employees who live in various communities around the Monument. The NPS also uses concession contracts and commercial use licenses (formerly incidental business permits) to manage commercial activities within its units. Currently, the only concession contract is issued to the non-profit Craters of the Moon Natural History Association. This contract allows the association to offer convenience items such as sunscreen, film, and soft drinks, as well as books and educational materials, for purchase by visitors in the NPS Visitor Center. There are no current commercial use licenses or incidental business permits issued for activities on NPS lands in the Monument. The Idaho Department of Fish and Game (IDFG) offers commercial use licenses on BLM-administered lands.

Under the National Parks Air Tour Management Act of 2000 and FAA regulations, NPS, as a cooperating agency, will assist the FAA in developing an air tour management plan for parks with existing or proposed air tours. No air tours currently take place over NPS-administered lands in the Monument on any regular or frequent basis. There has been one inquiry, but no proposals.

As Figure 23 illustrates, the Monument receives approximately 200,000 visitors per year, with peak visitation occurring from mid-May through September. The principal visitor activities are touring the Visitor Center/Museum, taking the self-guided driving tour, and hiking the many trails off the 7-mile Loop Drive. Visitation to the Monument has been relatively stable over the past 35 years, with fluctuations in the 1970s and 1980s, possibly due to increases in gasoline prices and weakness in the national and regional economy.

The Monument is an integral part of central Idaho's rich and varied network of protected lands, which offer boundless recreational opportunities and attract visitors and residents from around the world. However, the changing economy is affecting the various counties and communities within the planning area in different ways. In addition to skiing at the renowned Sun Valley ski area, winter visitors to Blaine County may enjoy snowmobiling, cross-country skiing, and ice-skating. Summer tourists may golf, play tennis, fish, river raft, and enjoy music and arts festivals. The nearby Sawtooth National Recreation Area, the largest national recreation area

Figure 23
Park Visitation



in the National Forest System, averages more than one million visitor days per year. The Idaho Division of Tourism Development estimated in its 1997 Tourism Impacts Study that total tourism spending for Blaine County was $98.8 million (http://www.idoc.state.id.us/trvdiv/pdfs/travelspendingbycounty.xls).

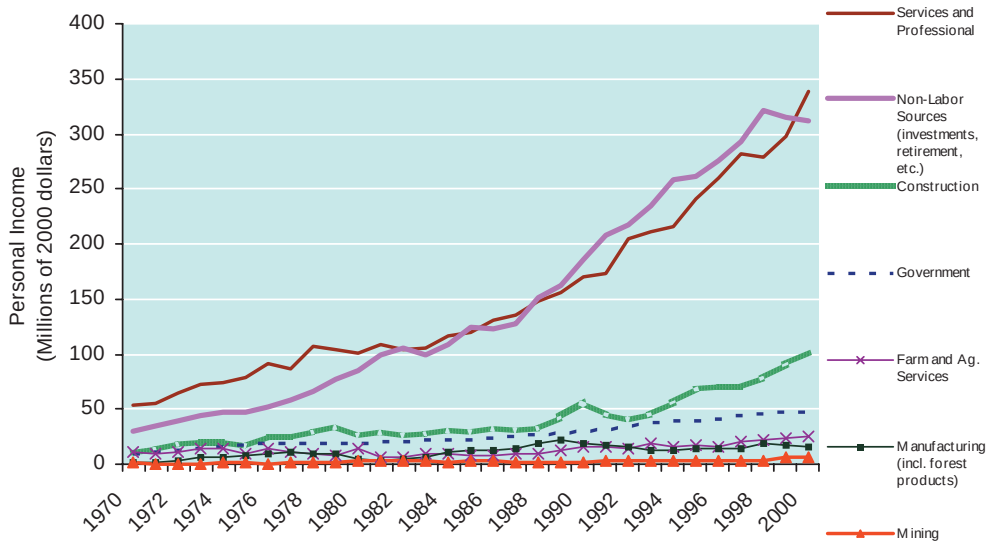
This is in contrast to total tourism spending in adjacent Lincoln County, which the same study estimated at $741,000, the lowest for any Idaho County. Despite the fact that the BLM Shoshone Field Office, located in Lincoln County, records an average of 900,000 visitors per year, most are passing through on their way to better-known tourism destinations. Throughout the planning region, residents of counties and communities that continue to depend more on traditional economic activities such as agriculture are not seeing the same increases in population, per capita income, or average earnings per job. However, as property values rise in the Sun Valley area, the search for affordable housing, along with the appeal of more traditional small town life, are pushing increasing numbers of residents into other communities in the Monument planning area. The Monument, and the recreational and environmental amenities it offers, may provide these communities with an important advantage over other Idaho towns in shaping themselves as appealing, unique places to retire, or locate new businesses.

The following section includes a summary of major changes in personal income and employment for each of the five counties of the planning area. Later sections will explore demographic and social distinctions between the counties and communities.

The largest portion of the Monument, 51 percent, is located within Blaine County, which includes the towns of Sun Valley, Ketchum, Hailey, Bellevue, and Carey. Blaine County, more so than the other counties in the planning area, has what might be called an "amenity-driven" economy. The linchpin of economic and population growth, especially in the Sun Valley/Ketchum/Hailey area, is the desire to live in a picturesque rural setting with ample recreational opportunities. As a result, Blaine County has in effect created a diverse, almost urban economy in a rural setting.

The major economic changes in Blaine County mirror those occurring in most of the western United States. Since 1970, overall personal income in real terms (adjusted for inflation) in the county has increased by $684 million, to $797 million. Employment in all sectors has grown by 13,929 jobs over the same time frame, to a total of 17,443. Much of the growth in both income and employment has been in the Services and Professional category, accounting for 42 percent of the new income and 9,570 new jobs. Within this sector, hotels and lodging have

Figure 24
Change in Personal Income in Blaine County, Idaho, 1970-2000



Source: BEA REIS 2002 CD Table CA05 *Note: Data is in real terms (adjusted for inflation).*

Table 26
New Income by Type in Blaine County, Idaho, 1970-2000

All figures in millions of 2000 dollars	1970	% of Total in 1970	2000	% of Total in 2000	New Income 1970 to 2000	% of New Income
Total Personal Income*	114		797		684	
Farm and Agricultural Services	11	9.9%	25	3.2%	14	2%
Farm	10	8.9%	6	0.7%	-4	NA
Ag. Services	1	1.1%	19	2.4%	18	3%
Mining	1	1.1%	7	0.9%	6	1%
Manufacturing (incl. forest products)	2	1.5%	15	1.9%	14	2%
Services and Professional	53	46.6%	338	42.4%	285	42%
Transportation & Public Utilities	2	1.6%	13	1.7%	11	2%
Wholesale Trade	2	1.5%	21	2.7%	20	3%
Retail Trade	15	13.0%	61	7.7%	47	7%
Finance, Insurance & Real Estate	3	2.4%	58	7.3%	55	8%
Services (Health, Legal, Business, Others	32	28.1%	184	23.1%	152	22%
Construction	11	9.4%	103	12.9%	92	14%
Government	10	9.0%	47	5.9%	37	5%
Non-Labor Income	30	26.1%	311	39.1%	282	41%
Dividends, Interest & Rent	22	19.0%	275	34.5%	253	37%
Transfer Payments	8	7.0%	37	4.6%	29	4%

*The sum of the above categories do not add to total due to adjustments made for place of residence and personal contributions for social insurance made by the U.S. Department of Commerce.

grown from $15.5 million in 1990 to $26.6 million. Amusements and recreation has increased from $2.3 million to $34.1 million in the same time frame. It is likely that the majority of increases in these sectors are due to the ski resort economy, but some may be tied to the Monument.

Non-labor income, including investment and retirement income, has increased nearly as much in real terms, accounting for 41 percent of new income in the county. Blaine County's rapid population growth (see the next section) has fueled strong growth in construction as well, adding 14 percent of the county's new income and 2,441 jobs over the past 30 years. Government has grown more modestly, contributing 5 percent of the county's new income and 836 new jobs.

Sectors that were traditionally more important to the area's economy and identity, such as agriculture and forest products (included in the manufacturing category), have increased only slightly, each adding 2 percent of the county's new income. Agriculture added 685 new jobs, while manufacturing added 362 over the past 30 years. The relatively modest growth in agricultural income is related to the subdivision of working ranches into smaller "ranchettes" that engage in little agricultural production. Mining has also increased very slightly, contributing about 1 percent of the county's new income and 35 new jobs.

In Blaine County, per capita income in real terms from 1990 to 2000 increased by 27 percent, from $32,883 to $41,734, the highest by far of the counties within the planning area. Average earnings per job in real terms (adjusted for inflation) have risen from $25,062 in 1970 to $30,709 in 2000, and are higher than the state average of $28,302, but lower than the national average of $36,311. The average annual unemployment rate in Blaine County was 2.9 percent in 2001, compared to 5 percent for the state and 4.8 percent for the nation.

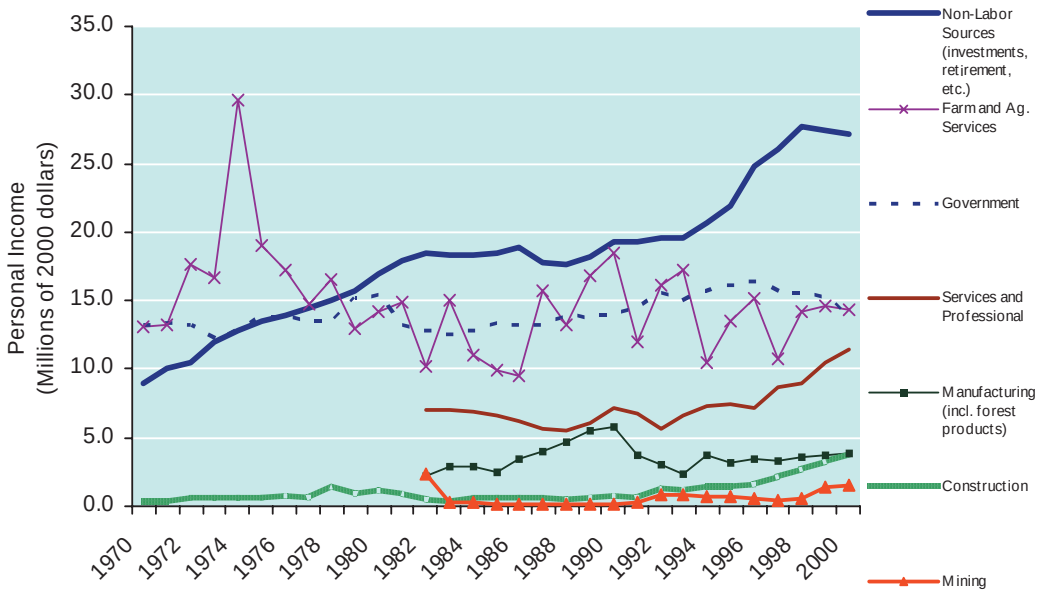
Despite Blaine County's prosperity, it should be noted that most of the new business growth, along with higher income residents, is centered on the Sun Valley/Ketchum area, and decreases heading toward the Big Wood River Valley to Hailey, Bellevue, and Carey.

Lincoln County's economy is unusual compared to many in the western United States in that the Services and Professional sector plays a relatively minor role, while agriculture accounts for a larger share of both jobs and income. Lincoln County had a 2002 population of 4,057, approximately 25 percent less than Blaine County. The city of Shoshone is the county's largest population center, with 1,398 residents. Although only 2 percent of the Monument lies within Lincoln County, US 93 passes through the county before following the Monument's northwestern boundary, and connects the area to the more populous Snake River Valley.

Data on personal income for all categories was not available until 1982; therefore, this section considers changes from 1982-2000. From 1982-2000, total personal income in Lincoln County increased by $26 million, to a total of $81 million in real terms (adjusted for inflation). New employment increased by 125 jobs among all sectors, reflecting the balance of gains and losses in various sectors. Non-labor income was the largest source of income in the county around 1980, contributing 33 percent of the total new income since 1982. Farm and agricultural services was the county's second most important source of income in 2000, contributing 17.8 percent of the county's total income and 16 percent of the new income since 1982, but losing 138 jobs over that time frame. This reflects the volatile nature of earnings from this sector. Government is the third most important sector, accounting for 16.9 percent of total county income, but adding only 3 percent of the county's new income and 36 jobs.

Although Services and Professional is the fourth most important source of income in the county, it is the fastest growing source of employment; this sector contributed 17 percent of the county's new income since 1982, and added 150 new jobs.

Figure 25
Change in Personal Income in Lincoln County, Idaho, 1982-2000



Source: BEA REIS 2002 CD Table CA05 *Note: Data is in real terms (adjusted for inflation). Data for all sectors was not available prior to 1982.*

Table 27
New Income by Type in Lincoln County, Idaho, 1982-2000

All figures in millions of 2000 dollars	1982	% of Total in 1982	2000	% of Total in 2000	New Income 1982 to 2000	% of New Income
Total Personal Income*	54		81		26	
Farm and Agricultural Services	10	18.8%	14	17.8%	4	16%
Farm	9	17.4%	12	15.5%	3	12%
Ag. Services	1	1.4%	2	2.3%	1	4%
Mining	2	4.4%	1	1.8%	-1	NA
Manufacturing (incl. forest products)	2	4.2%	4	4.8%	2	6%
Services and Professional	7	12.9%	11	14.2%	4	17%
Transportation & Public Utilities	3	5.5%	2	2.5%	-1	NA
Wholesale Trade	0	0.7%	1	1.7%	1	4%
Retail Trade	2	3.1%	1	1.7%	0	NA
Finance, Insurance & Real Estate	1	1.2%	2	2.5%	1	5%
Services (Health, Legal, Business, Others	1	2.4%	5	5.8%	3	13%
Construction	0	0.7%	4	4.6%	3	13%
Government	13	23.6%	14	16.9%	1	3%
Non-Labor Income	18	34.0%	27	33.8%	9	33%
Dividends, Interest & Rent	11	19.6%	14	17.8%	4	14%
Transfer Payments	8	14.3%	13	16.0%	5	19%

*The sum of the above categories do not add to total due to adjustments made for place of residence and personal contributions for social insurance made by the U.S. Department of Commerce.

If trends across the West (and the rest of planning area) are indicative, continued growth can be expected for this sector. However, the subcategories within the sector that may be most influenced by an increase in Monument visitors have not fared well recently. From 1990 to 2000, personal income from hotels and other lodging decreased by $7,900, while amusements and recreation grew from $176,500 in 1990 to $251,000 in 2000.

While still a relatively minor income source, construction added 117 new jobs to the county's economy and 13 percent of the new income, and has grown steadily over the past decade. Manufacturing contributed 6 percent of the new income and added 31 new jobs. Mining declines subtracted 1 percent from county's income and accounted for 72 lost jobs.

Per capita income in Lincoln County increased in real terms by 2 percent from 1990 to 2000, from $19,465 to $19,843. Average earnings per job (adjusted for inflation) have risen from $22,932 in 1970 to $23,371 in 2000. However, average earnings in this county are lower than the state average ($28,103) and the nation ($36,316). The average unemployment rate in 2001 was 3.9 percent, compared to 5 percent for the state and 4.8 percent for the nation.

The northern portion of the Monument is located within Butte County, which accounts for 18 percent of the Monument. Arco is the largest Butte County town within the planning area and home to 1,026 of the county's 2,896 people. As the graph above suggests, gaps in government data reporting, along with the reclassification of some jobs at the county's largest employer (INEEL) from Manufacturing and Government to Services and Professional, make analysis of economic change in Butte County challenging. In some cases, the disclosure estimation system of the Economic Profile System (see www.sonoran.org/eps) was used to estimate data gaps. Data for all sectors was not available until 1990; thus changes over the decade from 1990-2000 are described below.

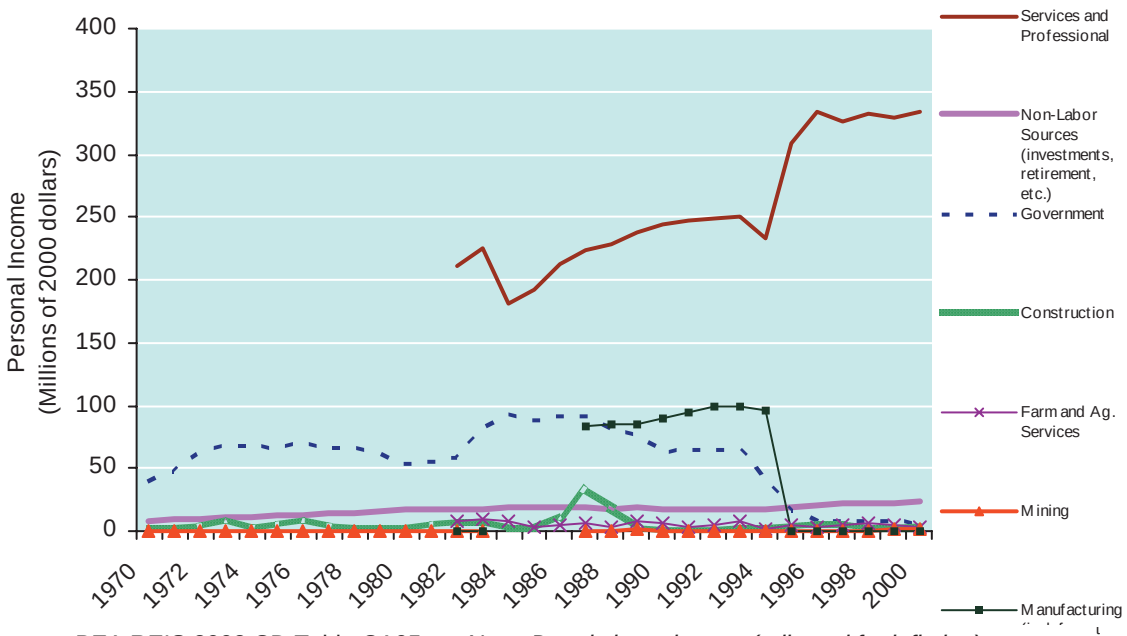
Total personal income in Butte County was $373 million in 2000. The income mix in Butte County is unusual due to relatively low contributions of non-labor income, the reclassification by the U.S. Department of Commerce, and actual job losses from the manufacturing and government sectors. Even considering the reclassification of sectors for INEEL jobs, the county lost a total of 1,228 jobs over the past 30 years.

Despite the job losses, combined personal income in Butte County increased by $15 million, to $66 million, from 1990 to 2000 in real terms (adjusted for inflation). Non-labor income was the only other sector that expanded significantly from 1970 to 2000, by $6 million in real terms, compared to a $282 million increase in Blaine County.

Construction added $3 million in personal income and 38 jobs from 1990-2000, while mining income increased by $1 million and added five jobs. Although farm and agricultural services added four jobs, personal income from this sector declined by $4 million. The West-wide decline in agricultural income is often linked to the sale of working ranches to non-working "ranchettes" or subdivisions; but these factors seem to be less prevalent in Butte County, which does not attract the same level of "amenity buyers" that Blaine County does. Instead, the decline appears to be caused by international competition and the changing agricultural market.

An important feature of the Butte County economy is that despite the relatively high numbers of well-paying Engineering and Management Service jobs, almost four times as much money leaves the county as is generated in total personal income. INEEL is the county's major employer; of the total $334 million generated by employment in Services, $332 million is subcategorized as Engineering and Management Services, most of which is linked to INEEL. However, many of its employees choose to live in Idaho Falls or other area towns, rather than in Arco, and take their income with them. In 2000, more than $282 million in personal earnings left the county. This also accounts for the relatively low

Figure 26
Change in Personal Income in Butte County, Idaho, 1990-2000



Source: BEA REIS 2002 CD Table CA05 *Note: Data is in real terms (adjusted for inflation). Data for all sectors was not available prior to 1990.*

Table 28
New Income by Type in Butte County, Idaho, 1990-2000

All figures in millions of 2000 dollars	1990	% of Total in 1990	2000	% of Total in 2000	New Income 1990 to 2000	% of Lost Income
Total Personal Income*	422		373		-50	
Farm and Agricultural Services	6	1.5%	3	0.8%	-3	6%
Farm	6	1.4%	3	0.7%	-3	6%
Ag. Services	0	0.1%	0	0.1%	0	0%
Mining	0	0.1%	1	0.4%	1	NA
Manufacturing (incl. forest products)	90	21.4%	0	0.1%	-90	181%
Services and Professional	244	57.8%	334	89.6%	90	NA
Transportation & Public Utilities	1	0.2%	2	0.4%	1	NA
Wholesale Trade	1	0.1%	1	0.2%	0	NA
Retail Trade	3	0.7%	2	0.5%	-1	2%
Finance, Insurance & Real Estate	0	0.1%	1	0.2%	0	NA
Services (Health, Legal, Business, Others	239	56.6%	329	88.3%	90	NA
Construction	1	0.1%	3	0.9%	3	NA
Government	63	14.9%	7	1.9%	-56	112%
Non-Labor Income	18	4.3%	24	6.3%	6	NA
Dividends, Interest & Rent	10	2.4%	12	3.3%	2	NA
Transfer Payments	8	1.9%	12	3.1%	4	NA

*The sum of the above categories do not add to total due to adjustments made for place of residence and personal contributions for social insurance made by the U.S. Department of Commerce.

portion of non-labor income found here. One factor may be that when INEEL was founded, Bonneville County provided bus service to INEEL employees who wished to live there rather than in Butte County.

Services income within the subcategories of hotels and other lodging and amusements and recreation do not appear to be benefiting from Monument expansion. From 1990 to 2000, personal income from hotels and other lodging declined from $35,000 to $30,000, while no personal income from amusements and other recreation was recorded in either 1990 or 2000. The area is attempting to diversify its economy further through initiatives such as the Arco/Butte Business Incubation Center.

Despite the changes to the Butte County economy over the past 30 years, per capita income in real terms increased by 32 percent, from $17,202 to $22,625 from 1990 to 2000. Average earnings per job (adjusted for inflation) have increased from $40,103 in 1970 to $50,512 in 2000, the highest among the counties in the planning region. In 1999, average earnings per job in Butte County were higher than the average for the state of Idaho ($28,103) and higher than the national average ($36,316). The average unemployment rate in the county was 3.9 percent in 2001, compared to the state average of 5 percent and the national average of 4.8 percent.

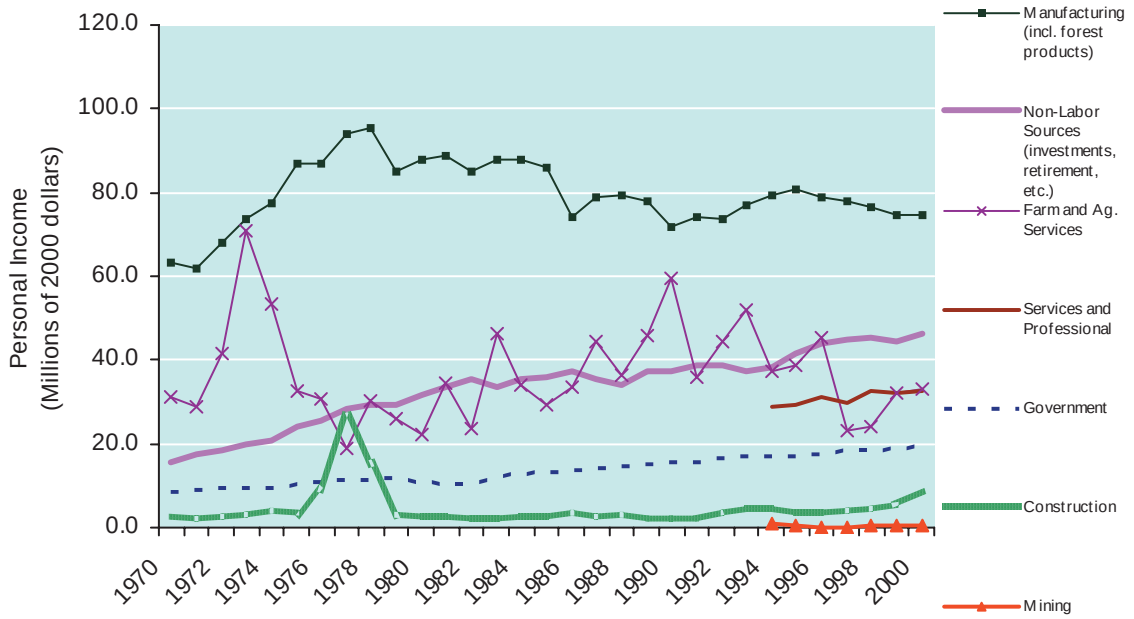
Power County encompasses the southwestern corner of the Monument, accounting for 7 percent of the Monument, and had a total population of 7,515 in 2000. There are no communities within Power County that are considered part of the planning area, although the city of American Falls, where the American Falls Reservoir and hydroelectric generating plant are located, lies approximately 10 miles to the east of the Monument. In 2000, total personal income in the county was $164 million and 5,604 people were employed.

Power County has a high level of manufacturing income, due largely to jobs at the American Falls Electrical Generating Station (the county's major employer) being classified in this sector. Employment in this sector has fluctuated, but declined by 209 jobs over the past three decades and accounted for 45.5 percent of earnings in real terms in the county in 2000. Non-labor income accounted for $46 million, or 28.3 percent, of county personal income in 2000. Although farm and agricultural income increased by $1 million to a total of $32 million between 1970 and 2000 and added 50 jobs, its share of total personal income declined from 31.7 percent to 19.6 percent over the same time span. Its share of employment declined from 28.9 to 21.4 percent of all jobs.

Missing data for the services and professional and mining sectors make long-term analysis of economic change in Power County challenging. However, it is possible to say that from 1994 to 2000, income from the services and professional sector contributed 48 percent of new income to the county for a total of $33 million, or 20 percent of total personal income adjusted for inflation. This sector added 37 jobs during that time frame to account for a total of 1,499 positions. The services subcategories of hotels and other lodging and amusements and recreation grew substantially in the county from 1990 to 2000. Hotels and other lodging increased from $36,600 in 1990 to $116,500, while amusements and recreation grew from $109,400 to $191,000. Construction has been the fastest growing sector from 1994-2000, contributing 53 percent of new income in the county and adding 139 jobs. Government jobs have steadily increased over the past three decades, and now account for 11.7 percent, or $19 million, in personal income in 2000, along with 735 jobs. Mining accounted for five jobs and 0.2 percent of total personal income in 2000.

From 1990 to 2000, per capita income in Power County decreased in real terms by 9 percent, from $23,825 to $21,782. Average earnings per job (in real terms) fell from $31,662 in 1970 to $30,113 in

Figure 27
Change in Personal Income in Power County, Idaho, 1970-2000



Source: BEA REIS 2002 CD Table CA05 *Note: Data is in real terms (adjusted for inflation). Data for all sectors was not available prior to 1994.*

Table 29
New Income by Type in Power County, Idaho, 1994-2000

All figures in millions of 2000 dollars	1994	% of Total in 1994	2000	% of Total in 2000	New Income 1994 to 2000	% of New Income
Total Personal Income*	155		164		8	
Farm and Agricultural Services	37	23.9%	33	20.3%	-4	NA
Farm	35	22.8%	30	18.6%	-5	NA
Ag. Services	2	1.1%	3	1.7%	1	14%
Mining	1	0.5%	0	0.2%	0	NA
Manufacturing (incl. forest products)	79	51.2%	74	45.5%	-5	NA
Services and Professional	29	18.5%	33	20.0%	4	48%
Transportation & Public Utilities	11	7.0%	11	7.0%	1	6%
Wholesale Trade	6	3.7%	7	4.1%	1	11%
Retail Trade	5	3.1%	4	2.4%	-1	NA
Finance, Insurance & Real Estate	1	0.9%	1	0.8%	0	NA
Services (Health, Legal, Business, Others	6	3.6%	9	5.7%	4	44%
Construction	4	2.8%	9	5.3%	4	53%
Government	17	11.1%	19	11.7%	2	23%
Non-Labor Income	38	24.8%	46	28.3%	8	93%
Dividends, Interest & Rent	21	13.2%	24	14.9%	4	46%
Transfer Payments	18	11.5%	22	13.3%	4	47%

*The sum of the above categories do not add to total due to adjustments made for place of residence and personal contributions for social insurance made by the U.S. Department of Commerce.

2000. Average earnings here are higher than the state average ($28,103) but lower than the national average ($36,113). In 2001, the unemployment rate in Power County was 7.2 percent, compared to 5.0 percent for the state and 4.8 percent for the nation.

The south-central portion of the Monument, a total of 22 percent, lies within Minidoka County. The town of Minidoka (population 142) is within the planning area. Although non-labor and services are the most important sources of income in Minidoka County, and the service sector is the largest source of employment, this county depends on a more diverse range of economic sectors than many counties in the western United States. The county added 3,370 jobs between 1970 and 2000, bringing the total number to 11,033. Total personal income was $345 million in 2000. Non-labor income accounts for 32 percent of personal income in the county, and 60 percent of the new income generated between 1970 and 2000 in real terms (adjusted for inflation). Services is the second most important sector economically, accounting for 25 percent of income in the county, 28 percent of the new income, and 2,391, or 71 percent of new jobs. From 1990 to 2000, personal income within the hotels and other lodging subcategory for Minidoka County increased from $1.69 million in 1990 to $1.74 million in 2000. During that time frame, amusements and recreation increased by $99,000.

Manufacturing remains the third most important source of income and jobs in the county, although its share of total income has declined slightly from 18.5 to 17.9 percent. Although this sector contributed to 17 percent of the new income in the county, it only added 61 jobs, or 1.8 percent of the total, from 1970 to 2000.

Agriculture has been a key sector of the county's economy over the past 30 years and is currently the fourth most important source of income and the second largest employer. However, the share that agriculture contributes to new personal income from 1970 to 2000 fell by $16 million in real terms, while 121 jobs were added.

Government and construction have shown steady increases in both personal income and jobs in the county over the past 30 years. Income from the government sector added 17 percent of the total new income, and it generated 544 new jobs, or 16.1 percent of the total. Construction contributed $1 million, or 1 percent, of the county's new income, and 180, or 5.3 percent, of the new jobs. Mining has not been an important economic sector in Minidoka County over the past 30 years, comprising only 0.1 percent of personal income in the county; however, 73 jobs were added in this sector during that time frame.

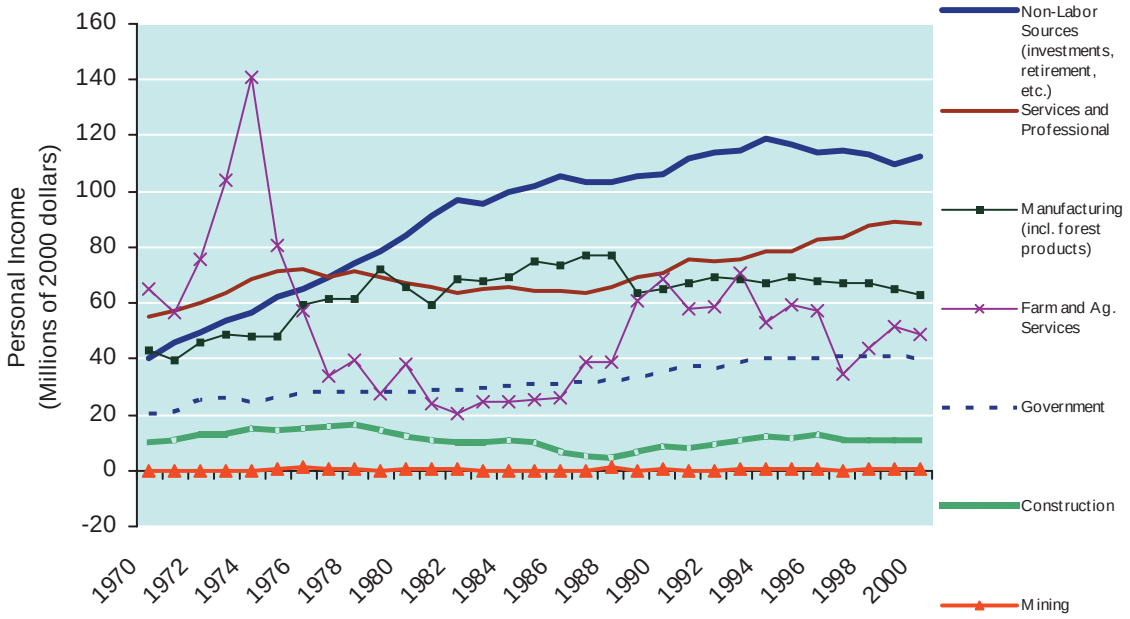
Per capita income for Minidoka County in real terms held steady from 1990 to 2000 at $17,589. Average earnings per job (in real terms) have declined from $25,231 in 1970 to $22,823 in 2000, and are lower than the state ($28,301) and national ($36,311) averages. Unemployment for 2001 was 6.4 percent, compared to 5.0 percent for the state and 4.8 percent for the nation. Although the economic profile of Minidoka County is common throughout the western United States, the county has the lowest income of any in the planning area; and the town of Minidoka magnifies this trend. The county and town also have some demographic features that differ from the rest of the planning area, as discussed in the following section.

Population Growth, Housing Values and Commuting Patterns

Some of the most notable distinctions among the communities within the planning area are in population growth rates and housing values. These factors have important implications for land use and planning in the vicinity of the Monument.

Between 1990 and 1999, the populations of Idaho and the Mountain West grew at more than twice the United States average. According to the U.S. Census Bureau, the fastest growing populations in the nation are intermountain western states: Nevada (1), Arizona (2), Idaho (3), Utah (4), and Colorado (5). Nevada and Idaho are predicted to be the two fastest growing states in the nation until at least 2005. Since

Figure 28
Changes in Personal Income in Minidoka County, Idaho, 1970 - 2000



Source: BEA REIS 2002 CD Table CA05 *Note: Data is in real terms (adjusted for inflation).*

Table 30
New Income by Type in Minidoka County, Idaho, 1970-2000

All figures in millions of 2000 dollars	1970	% of Total in 1970	2000	% of Total in 2000	New Income 1970 to 2000	% of New Income
Total Personal Income*	233		354		121	
Farm and Agricultural Services	65	28.0%	49	13.8%	-16	NA
Farm	62	26.5%	40	11.4%	-21	NA
Ag. Services	3	1.5%	8	2.4%	5	4%
Mining	0	0.0%	0	0.1%	0	0%
Manufacturing (incl. forest products)	43	18.5%	63	17.9%	20	17%
Services and Professional	55	23.7%	89	25.0%	33	28%
Transportation & Public Utilities	8	3.3%	26	7.3%	18	15%
Wholesale Trade	9	3.8%	23	6.6%	14	12%
Retail Trade	18	7.9%	13	3.8%	-5	NA
Finance, Insurance & Real Estate	2	1.0%	3	0.8%	1	0%
Services (Health, Legal, Business, Others)	18	7.8%	23	6.6%	5	4%
Construction	10	4.1%	10	2.9%	1	1%
Government	20	8.6%	41	11.5%	20	17%
Non-Labor Income	40	17.2%	113	31.9%	73	60%
Dividends, Interest & Rent	23	9.8%	50	14.1%	27	22%
Transfer Payments	17	7.4%	63	17.8%	46	38%

*The sum of the above categories do not add to total due to adjustments made for place of residence and personal contributions for social insurance made by the U.S. Department of Commerce.

1990, Idaho's statewide population has increased by more than 27,000 people per year. Two-thirds of these additional people have moved to the cities and towns of Idaho (Cooke 2000).

In the more than 200 cities and towns in Idaho, more than one-half of the towns have increased slightly in population size. Roughly 24 cities and towns have lost population since 1990. At the other extreme, approximately 24 cities have increased by more than 100 persons per year.

Table 31 summarizes population growth rates and current residents for the counties and communities within the Craters of the Moon National Monument planning area.

As the table shows, Blaine County has experienced the most rapid growth among the five counties in the planning area, adding 14,543 people and growing by 250 percent from 1970 to 2002. During this time frame, population growth has been steady, and has outpaced both the state of Idaho (87 percent) and the nation (41 percent). Blaine County is the most populous county in the planning area, just slightly larger than Minidoka County, and is likely to continue to grow at a much faster rate. Blaine County contains the largest community in the planning area, Hailey, which had 6,002 residents in 2000. It is also the location of Sun Valley (population 1,427), Ketchum (population 3,003), Bellevue (population 1,876) and Carey (population 513).

Power County had the second-fastest growth rate, although its 7,419 residents in 2000 and 55 percent growth rate are dwarfed by Blaine County's figures. Power County has grown slower than the state (an 87 percent increase) but faster than the nation (41 percent) during this time frame. Much of the population growth occurred from 1970 to 1980, has slowed since then, and actually began declining in 1999.

Lincoln County grew by 1,143 people, or 37 percent, from 1970 to 2002, bringing its population to 4,057, or about one-fifth of Blaine County. This rate was slower than both the state and the nation. The county's population was fairly stable from 1970 to 1990, and has been trending steadily upward since then. The town of Shoshone (population 1,398) is in Lincoln County.

Table 31
Population and Growth Rates for Planning Area Counties and Communities

COUNTY	COMMUNITY	1970 POPULATION	2000 POPULATION	TOTAL PERCENT CHANGE 1970-2002	ANNUAL PERCENT CHANGE 1970-2000
Blaine		5,815	20,358	250%	4%
	Sun Valley		1,427		
	Ketchum		3,003		
	Hailey		6,002		
	Bellevue		1,876		
	Carey		513		
Lincoln		3,083	4,057	37%	1%
	Shoshone		1,398		
Butte		2,918	2,921	0%	0%
	Arco		1,026		
Power		4,848	7,419	53%	1.3%
Minidoka		15,873	19,444	22%	0.6%
	Minidoka		129		

Minidoka County, where the town of Minidoka (population 142) is located, grew by 22 percent, or 3,571 people, from 1970 to 2002, which is considerably slower than both the state at 87 percent and the nation at 41 percent. Most of this growth occurred between 1970 and 1980, and the population has been fairly stable since then. Minidoka County is the most populous county in the planning area, with 19,444 residents in 2002.

Butte County has experienced virtually no population growth over the past 32 years, adding only three residents to its population of 2,921. The town of Arco (population 1,029) accounts for more than one-third of the county's population. Butte County's population grew at a moderate rate from around 1978 to 1983, peaking at around 3,500 residents, and then began gradually declining.

Housing Affordability and Commuting Patterns

It is important to consider housing affordability in planning for Craters of the Moon because it will have significant impacts on future population growth (and potentially resource use) for the towns in the planning area. Housing values and affordability vary considerably among the communities of the planning area, as Figure 29 shows.

Table 32 shows where each community lies on the Housing Affordability Index (HFI), which is another means of illustrating the differences in housing affordability between communities. This measure considers median home value and median household income, and assumes a 20 percent down payment and that no more than 25 percent of a family's income goes to paying the mortgage. It is based on an interest rate of 10.01 percent in 1990 and 8.03 percent in 2000. This statistic is most useful as a comparative, rather than absolute, measure. By this measure, a score of 100 or above means that the median family can afford the median house.

Sun Valley, Ketchum, and Hailey are experiencing one of the downsides of rapid economic and population growth: a serious lack of affordable housing. The problem is most severe in Sun Valley, where the median home value was $798,400 in 2000, and the income required to quality to buy the median home was $225,603; but the median household income was only one-third of the income needed to qualify, or $71,000.

The situation is similar in Ketchum, where buying the $500,000 median value home requires an income of $142,217; but again, the median household income of $45,457 is only one-third of what would be

Figure 29
Housing Affordability in Planning Area Communities

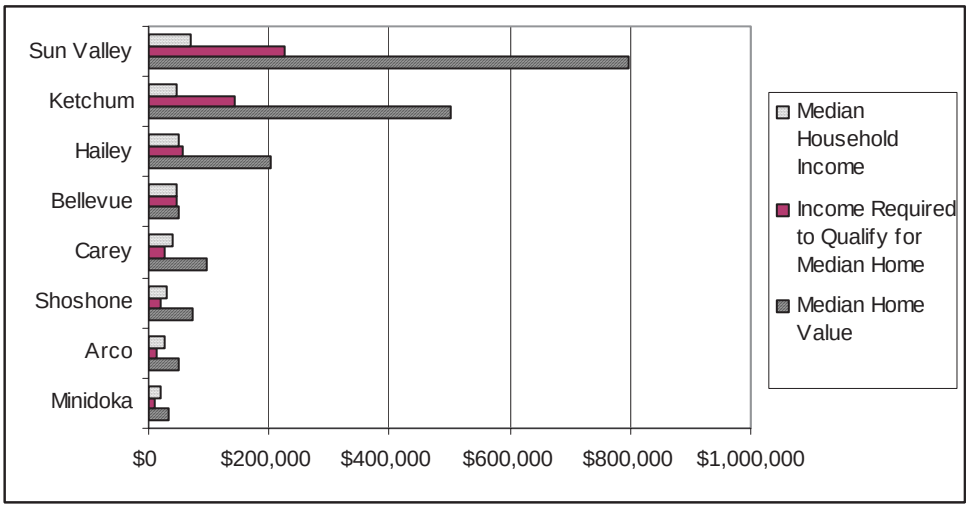


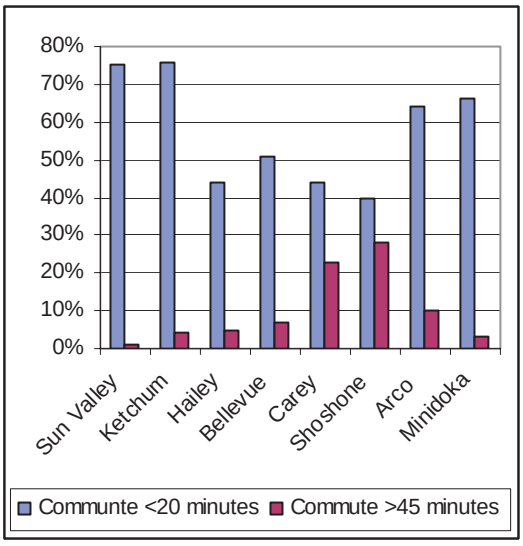
Table 32
Housing Affordability Index for Planning Area Communities

COMMUNITY	SUN VALLEY	KETCHUM	HAILEY	BELLEVUE	CAREY	SHOSHONE	ARCO	MINIDOKA
HFI	38	52	100	110	157	175	240	173

required to qualify. The gap is narrower in Hailey, where the median-value $203,000 home requires an income of $56,599, and the median household income is $51,347.

Place of work and commuting patterns are valuable indicators of the various economic roles played by different communities within the study area, and are closely related to housing affordability. Ketchum had the highest percentage of residents (72 percent) who said they work in town, compared to 55 percent of Sun Valley residents and 39 percent of Hailey residents. As Figure 30 indicates, residents of Sun Valley and Ketchum are unlikely to commute more than 20 minutes to their jobs, which are presumably in these towns. Hailey lies approximately 13 miles, or about 20 minutes, from Sun Valley, and many of its residents are likely to work there or in Ketchum.

Figure 30
Commuting Patterns in Planning Area Communities



A few more miles down the Big Wood River Valley to Bellevue brings housing into the affordable range for more people and is a major reason for its population growth in recent years. In this community, the median value home of $159,200 requires an annual income of $44,985, while the median household income is $45,438. Bellevue lies 19 miles, or a 27-minute drive, from Sun Valley, which may explain why 39 percent of its residents commute for 20 to 45 minutes each way. Only 7 percent have commutes of longer than 45 minutes, while 51 percent commute for less than 20 minutes. Sixteen percent of residents said that they worked in town in 2000.

Some households with lower-than-median incomes that are employed in Sun Valley, Ketchum, or Hailey are looking to Carey, 42 miles or nearly a one-hour drive from Sun Valley, for more affordable housing. In 2000, 39 percent of residents said that they worked in town. The median home in Carey is valued at $95,000, requiring an income of $26,884 to qualify to purchase it; while median household income is $39,861. New subdivisions are being built in Carey to meet the demand for affordable housing. Commuting data for Carey illustrates its residents' ties to other areas for work: 44 percent have commutes of less than 20 minutes, while 23 percent commute longer than 45 minutes. This traditional community is likely to grow quickly over the next several years, which may have implications for the Monument. Carey is adjacent to the western side of the Monument, and only 24 miles from the Visitor's Center.

Shoshone is a larger community located 57 miles or one hour and 15 minutes from Sun Valley, and offers even more affordable housing options to those employed in the Sun Valley/Ketchum/Hailey

area, as well as those who work closer to home. The median home value in Shoshone is $72,500, which requires an income of $20,486 to qualify for, compared to the median income of $31,036. Forty percent of residents said that they work in town. Commuting patterns for Shoshone indicate that it is a "bedroom community" for both the Sun Valley and Twin Falls (27 miles to the south) areas: only 40 percent of its residents over age 16 have a commute time of under 20 minutes, while 28 percent commute for more than 45 minutes each way. The residents of Shoshone are more likely to have longer commutes than others in the planning area.

As Figure 30 indicates, residents of Arco and Minidoka are more likely to work within 20 minutes of home and less likely to engage in long commutes to other towns. Most residents of Arco (59 percent) say that they work in town. Arco lies just north of the Monument, at least a 90-minute drive from Sun Valley/Ketchum, although some of its residents may commute to jobs at INEEL. The Monument's Visitor Center is 18 miles from Arco, making this town geographically the closest to being a gateway community for the Monument. Housing is affordable in Arco: the median home value is $51,200, requiring an income of only $14,486 to qualify, while the median household income is nearly twice that, at $27,998.

Minidoka, on the southern side of the Monument, has the most affordable housing of the communities in the planning area. The median home value is $33,100, which requires an income of $9,353 to qualify for purchase; the median household income is $21,250. It lies more than 100 miles from Sun Valley and Ketchum, making commutes to those areas unlikely. No Minidoka residents reported that they work in town. Instead, they are more likely to commute to American Falls or the Rupert/Burley area to work.

There are three airports in the general area of the Monument –Hailey, Idaho Falls, and Twin Falls (60, 84, and 90 miles from Park Headquarters, respectively). From the nearest towns by vehicle, travel to the Monument is 18 miles west of Arco via US 20/26/93; 24 miles east of Carey via US 20/26/93; 84 miles from Idaho Falls; and 90 miles from Twin Falls.

Demographic Change in the Planning Area

In addition to differences in terms of economic changes, population growth, housing affordability, and commuting patterns, demographic shifts are also affecting the communities. This section examines some of these factors for each community, including length of time in the community, age of residents, race and ethnicity, and languages spoken.

Length of Time in the Area

Length of time in the community can indicate how quickly a community is changing and provide some insight into the perspectives of community members from different areas. Trends in aging among residents have important implications for communities as well. This section discusses these issues within the planning area communities. Table 33 summarizes information about long-term residents and more recent arrivals.

Most residents of the communities in the planning area were born in the United States – but there are important differences within this broad category. Carey and Arco have the highest percentages of people born in the United States (97 percent and 98 percent, respectively). These are also the locations with the largest proportion of people born in Idaho (71 percent and 56 percent, respectively). These communities are among the more stable, with 67 percent of Carey residents living in the same house as they did in 1995, and 82 percent living in the same county. Half of the population of Arco lives in the same house as in 1995, and 73 percent live in the same county.

These trends are in contrast to those seen in the wealthier, faster-growing communities of the planning area. Residents of Sun Valley and Ketchum, and to a lesser extent Hailey and Bellevue, are less likely to have been born in Idaho and more likely to have moved to these towns within the past decade. Only 13 percent of Sun Valley residents and 16 percent of Ketchum residents were born in

Idaho. In 1995, 14 percent of Sun Valley residents lived outside the United States. This is likely to be due to the fact that Sun Valley is an internationally renowned resort community, meaning that it draws both more wealthy international homeowners and more immigrant hotel and restaurant workers. Sun Valley also had the third-lowest percentage (84 percent) among towns in the planning area of people born in the United States. Bellevue had a similar percentage of foreign-born residents, presumably for the same reasons. These communities had the lowest proportions of residents who had lived in the same house or state in 1995, indicating that there are more residents who chose to move to these areas for natural or recreational amenities or for employment opportunities.

Shoshone has a mix of factors that indicate that both long-time residents and newcomers live in the community; it falls in the middle among the planning area communities for the factors listed below. For Carey, only 3 percent of its residents were not born in the United States, none of its residents lived outside of the United States in 1995, a majority of its residents live in the same house as in 1995, and it has the highest number of residents that were born in Idaho. The situation is similar in Arco, which had the highest percentage of U.S.-born residents, a majority of whom were born in Idaho and many of whom lived in the same state and county in 1995. These trends indicate that Carey and Arco are more traditional towns with many long-term residents whose views on the use of Monument resources may reflect more traditional land uses.

The town of Minidoka has by the lowest percentage of residents born in the United States at 65 percent. Despite the high number of foreign-born residents, the town appears to be fairly stable, with many residents living in the same house and county since 1995.

Race, Ethnicity, and Language

Another primary way that the communities of the planning area differ is in their racial and ethnic composition. Table 34 summarizes 2000 Census data for each community.

Data on language and ethnicity are in keeping with the data on place of birth and length of time in the same state, county, and house discussed above. Sun Valley has few residents who are not fluent in English, but also a fairly high number of residents who speak a language in addition to English. Most residents are white and few are Hispanic, indicating that relatively few immigrant service workers actually live in the town. Ketchum follows a similar pattern, although it has fewer residents who speak a language in addition to English, and more white and fewer Hispanic and/or "some other race"

Table 33
Place of Birth and Length of Residence in Planning Area Communities

	BORN IN THE U.S.	BORN IN IDAHO	LIVED IN SAME STATE IN 1995	LIVED IN SAME COUNTY IN 1995	LIVED IN SAME HOUSE IN 1995	LIVED OUTSIDE THE U.S. IN 1995
Sun Valley	86%	13%	76%	73%	42%	14%
Ketchum	89%	16%	71%	67%	39%	3%
Hailey	89%	33%	79%	68%	40%	3%
Bellevue	84%	37%	88%	83%	50%	4%
Carey	97%	71%	89%	82%	67%	0%
Shoshone	88%	52%	86%	70%	53%	1%
Arco	98%	56%	92%	73%	50%	0%
Minidoka	65%	58%	100%	91%	72%	3%

Table 34
Language, Race and Ethnicity in Planning Area Communities

	SPEAK ONLY ENGLISH	SPEAK ENGLISH "NOT WELL" OR "NOT AT ALL"	HISPANIC	WHITE	SOME OTHER RACE*
Sun Valley	84%	1%	7.1%	92.4%	7.6%
Ketchum	90%	3%	4.9%	94.7%	5.3%
Hailey	87%	4%	12%	89.7%	10.3%
Bellevue	80%	9%	19.3%	86.6%	13.4%
Carey	95%	2%	10.1%	92.8%	7.2%
Shoshone	83 %	4%	11.3%	88.9%	11.1%
Arco	96%	0%	3.6%	95.1%	4.9%
Minidoka	24%	19%	77.5%	31%	13.4%

Note: Figures for Hispanic, White and Some Other Race may add to more than 100 percent because the U.S. Census Bureau considers "Hispanic" to be an ethnicity, rather than a race; Hispanics can be of any race (white, black, American Indian, etc.)

residents. Hailey is similar in terms of languages spoken, although it does have a more ethnically and racially diverse population. The fact that 9 percent of Bellevue's residents are not fluent in English, nearly 20 percent of residents are Hispanic, and 13.4 percent are of a race other than English may indicate that lower-paid immigrant service workers who work in Sun Valley, Ketchum, or Hailey choose to live in Bellevue, perhaps to take advantage of the town's lower housing costs.

Carey and Arco's high percentages of English-only speakers and relatively low ethnic and cultural diversity highlight their status as more traditional towns with relatively few immigrants. Both towns are too far from the service-worker hubs of Sun Valley, Ketchum, and Hailey to be viable housing options for lower-paid employees who work in those towns. The mix of factors in Shoshone indicates that it is home to both long-term residents and some immigrant workers.

In Minidoka, 25 percent of its population speaks only English, 19 percent are not fluent in English, and more than 75 percent are Hispanic. This town is home to many immigrant workers who find jobs in the agricultural areas beyond the southern boundaries of the Monument, as well as some who are employed by the American Falls Electrical Generating Station.

Trends in Aging

One of the key demographic trends in the western United States, including the Craters of the Moon National Monument planning area, is the aging of the baby boomers. This trend is relevant for resource management planning in that retiring baby boomers may be drawn to the recreational opportunities, lower cost of living, affordable housing and slower pace of life afforded by rural communities near protected areas, and can thus be a significant source of new residents. Providing services to these new residents, such as health care, arts and entertainment, and home-related services such as architects, builders, and maintenance can be a source of economic growth for the area. On the other hand, young adults and those with young children may choose to leave an area if they find limited higher-wage employment opportunities. The loss of such workers, particularly educated ones, can make it more difficult to attract well-paid jobs to the area.

Both of these trends are occurring to varying degrees in all counties of the planning area. As Table 35 indicates Blaine County has experienced the fastest growth of baby boomers (a 7 percent increase from 1990 to 2000), which is not surprising given its reputation as a desirable retirement and second-home destination. The increase in this age group for the other counties ranged from 3 to 6 percent.

Table 35
Aging Trends in Planning Area Counties

COUNTY (COMMUNITIES)	MEDIAN AGE U.S. MEDIAN = 35.3 STATE MEDIAN = 33.2		BABY BOOMERS (AGED 40-54 IN 2000)		PERCENT OVER AGE 65		PERCENT UNDER AGE 20	
Blaine (Sun Valley, Ketchum, Hailey, Carey)	1990	2000	1990	2000	1990	2000	1990	2000
	33.3	37.4	21%	28%	7%	8%	28%	26%
Lincoln (Shoshone)	34.2	34.3	16%	20%	14%	13%	34%	22%
Butte (Arco)	33.2	38.3	17%	22%	13%	15%	37%	32%
Power	29.8	31.6	16%	22%	10%	10%	38%	37%
Minidoka (Minidoka)	30.3	33.5	16%	19%	12%	13%	38%	35%

Butte County has experienced the most rapid increase in median age, along with increases in its baby boomer and over-65 residents and a decrease in residents under-20 years of age. In keeping with this trend, several of the new businesses spawned with the help of the Arco/Butte Business Incubation Center relate to health care, such as hospice services and medical supplies. Although Lincoln County is not aging overall, it experienced a 12 percent decline in its under-20 population from 1990 to 2000. All other counties in the planning area experienced declines in the under-20 age group, ranging from 1 to 5 percent.

Income Distribution and Education Levels

Income levels are closely tied to educational attainment in the emerging Western economy, and as Tables 36 and 37 indicate, this holds true in the Monument planning area. While income distribution figures provide insight into current social conditions in the communities of the planning area, educational attainment is an important factor to consider for future economic planning. Having a well-educated workforce makes communities more appealing to businesses considering locating in them, and can thus be a key factor in economic prosperity.

Sun Valley has the highest median income, largest percentage of households earning more than $100,000 per year, smallest percentage of people with less than a high school diploma, and highest number of well-educated residents. However, it also has a fairly high number of individuals with incomes below the poverty level – most likely lower paid service workers.

Minidoka has the lowest median household income, the highest percentage of households earning under $30,000 per year, and the highest proportion of individuals with incomes below the poverty level. In addition, 88 percent of its residents lack a high school diploma, and none reported having a college degree in the 2000 Census.

The other communities fall at various points along the range. Those in the Big Wood River Valley (Sun Valley, Ketchum, Hailey, and Bellevue) tend to have median higher incomes, fewer households earning under $30,000, and fewer individuals in poverty. They also have better-educated residents. Carey residents have mid-range incomes and a fair number of households earning less than $30,000 per year, but very few residents in poverty. Shoshone and Arco residents have high percentages of total households earning less than $30,000 per year and relatively high proportions of individuals living in poverty (particularly Arco). About 25 percent of the residents of these communities did not graduate from high school, and a modest proportion are college graduates.

Table 36
Income Distribution in Planning Area Communities

COMMUNITY	MEDIAN HOUSEHOLD INCOME	HOUSEHOLDS UNDER 30K	HOUSEHOLDS OVER 100K	INDIVIDUALS WITH INCOME BELOW POVERTY LEVEL
Sun Valley	$71,000	21%	36%	15%
Ketchum	$45,457	31%	20%	9%
Hailey	$51,347	29%	9%	6%
Bellevue	$45,438	30%	6%	8%
Carey	$39,861	33%	4%	2%
Shoshone	$31,036	47%	4%	14%
Arco	$27,993	57%	3%	23%
Minidoka	$21,250	78%	0%	32%

Table 37
Educational Attainments in Planning Area Communities

COMMUNITY	LESS THAN HIGH SCHOOL	COLLEGE DEGREE OR GREATER	ADVANCED COLLEGE DEGREE
Sun Valley	3%	60%	24%
Ketchum	5%	52%	14%
Hailey	10%	39%	10%
Bellevue	23%	19%	4%
Carey	17%	16%	2%
Shoshone	23%	14%	5%
Arco	24%	13%	4%
Minidoka	88%	0%	0%