



National Park Service  
U.S. Department of the Interior  
Sunset Crater Volcano National Monument  
Flagstaff, Arizona

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# **Trail Plan and General Management Plan Amendment Environmental Assessment**

**June 17, 2013**





# Trail Plan and General Management Plan Amendment

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## Environmental Assessment

### Summary

At Sunset Crater Volcano National Monument, the NPS proposes to locate, add, eliminate, manage, and maintain hiking trails and associated infrastructure in a comprehensive trails system based on resource protection and visitor use and enjoyment. This Environmental Assessment (EA) also considers the modification of management zones identified in the monument's 2002 General Management Plan. The plan is needed to protect natural and cultural resources, while providing safe, reasonable access to the monument's trail system for a wide variety of user groups.

This EA evaluates a no action alternative and two action alternatives. All action alternatives are based on laws, regulations and policies, and public health and safety. The no action alternative represents current conditions and is also a baseline for comparison to the action alternatives for each respective component.

Alternatives B and C focus on providing reasonable access and a variety of trail recreation experiences. Both existing and new trails were evaluated in terms of access to attraction sites, variety in terrain, vegetation type, user type, popularity, safe travel, as well as resource protection and sustainability. As a result, some existing trails would be eliminated from use and a new trail system would link NPS management areas, U.S. Forest Service land, and popular sightseeing areas to ensure trail continuity through the monument and adjacent lands. Alternative C also analyzes the effects of modifying management zone identified in the monument's General Management Plan.

Public comments were received on alternatives A, B, and C during the public comment period. The preferred alternative was constructed from desired components of each action alternatives based on public comments and the objectives of this trail plan.

This EA has been prepared in compliance with the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA) to provide the decision-making framework that 1) analyzes a reasonable range of alternatives to meet objectives of the proposal, 2) evaluates potential issues and impacts to Sunset Crater Volcano National Monument's resources and values, and 3) identifies mitigation measures to lessen the degree or extent of these impacts. Resource topics addressed in this document include vegetation, special status species, wildlife, geologic resources and soils, visitor use and experience, and aesthetics. All other resource topics have been dismissed because the project would result in negligible or minor effects to those resources. No major effects are anticipated as a result of this project.

### Public Comment

If you wish to comment on the EA, you may enter your comments online at the National Park Service website Planning, Environment, and Public Comment system: (<http://parkplanning.nps.gov/sucrtrails>) or you may mail comments to the name and address below. This Draft Environmental Assessment will be on public review for 30 days ending July 19, 2013. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask

us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

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# PURPOSE AND NEED

## Introduction

Sunset Crater Volcano National Monument (Monument) is located in northern Arizona approximately 13 miles northeast from Flagstaff, Arizona with a population of approximately 53,000 (Figure 1). The monument was established by Presidential Proclamation No. 1911 on May 26, 1930 to provide proper protection for certain geologic formations. The Monument name was changed November 16, 1990 to Sunset Crater Volcano National Monument by the Smith River National Recreation Act, P.L. 101-612. The Monument occupies approximately 3,040 acres totally surrounded by the Coconino National Forest (CNF), managed by the United States Forest Service. Based on National Park Service (NPS) interpretation of the above-mentioned legislative mandates and NPS policies, the following purpose statement was formed to direct management decisions for the monument:

*"To preserve and protect Sunset Crater Volcano National Monument's geological formations, features, and resources for scientific interests and research, and for public interests, including scenic, educational, and recreational pursuits."* – General Management Plan 2002

Flagstaff's location in relation to other national parks, forest land and monuments creates a substantial tourism sector that provides a strong visitor base for the monument. The monument is also located along the corridor of US Highway 89, a major regional artery that serves as an important route between many of the region's natural attractions such as Sedona, the Grand Canyon, Lake Powell and many of the Utah State Parks. Interstate 40 (Route 66), about 15 miles south, is also a primary east-west highway for the continental U.S.A. As a result of its prime location near major highways, it is an area of heavy tourist traffic; the average annual visitation for the monument is 183,735 over the years 2008-2012 (<http://irma.nps.gov/Stats>).

Located next to the monument Visitor Center is the CNF's Bonito Campground, a popular summer recreation area containing 44 sites with RV access and the O'Leary Day Use Area. The campground serves as the primary developed camping area for monument visitors.

The purpose of this Trail Plan, General Management Plan (GMP) amendment and Environmental Assessment (EA) is to examine the environmental impacts associated with the proposal to construct a new hiking trail system within the monument and the surrounding CNF. The monument proposes to locate, add, eliminate, manage, and maintain trails and associated infrastructure based on resource protection and visitor use and enjoyment. In addition, this proposal seeks to refine management zones identified in the 2002 Sunset Crater Volcano National Monument GMP using up-to-date scientific information and subsequently established monitoring protocols.

The proposed action is needed to protect natural and cultural resources, while providing safe, reasonable access to the monument's trail system for a wide variety of user groups. The new hiking trail system would be constructed primarily in the southern portion of the park adjacent to the monument's Visitor Center, Lenox Crater, and Lava Flow trail (Figure 2).

This EA was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, regulations of the Council on Environmental Quality (CEQ) (40 CFR §1508.9), and the National Park Service Director's Order (DO)-12 (Conservation Planning, Environmental Impact Analysis, and Decision-Making).

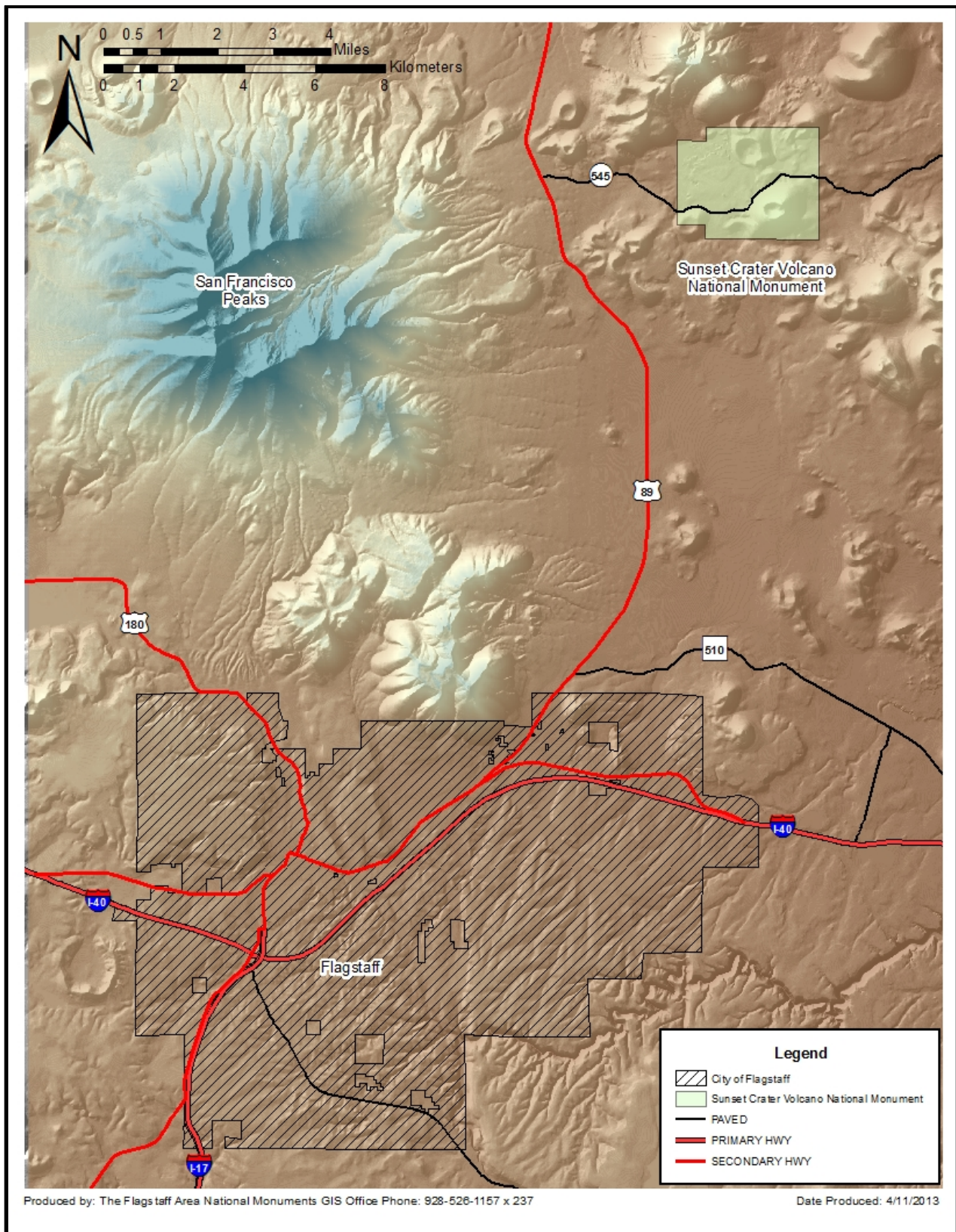


Figure 1. Flagstaff, Arizona in relation to Sunset Crater Volcano National Monument.

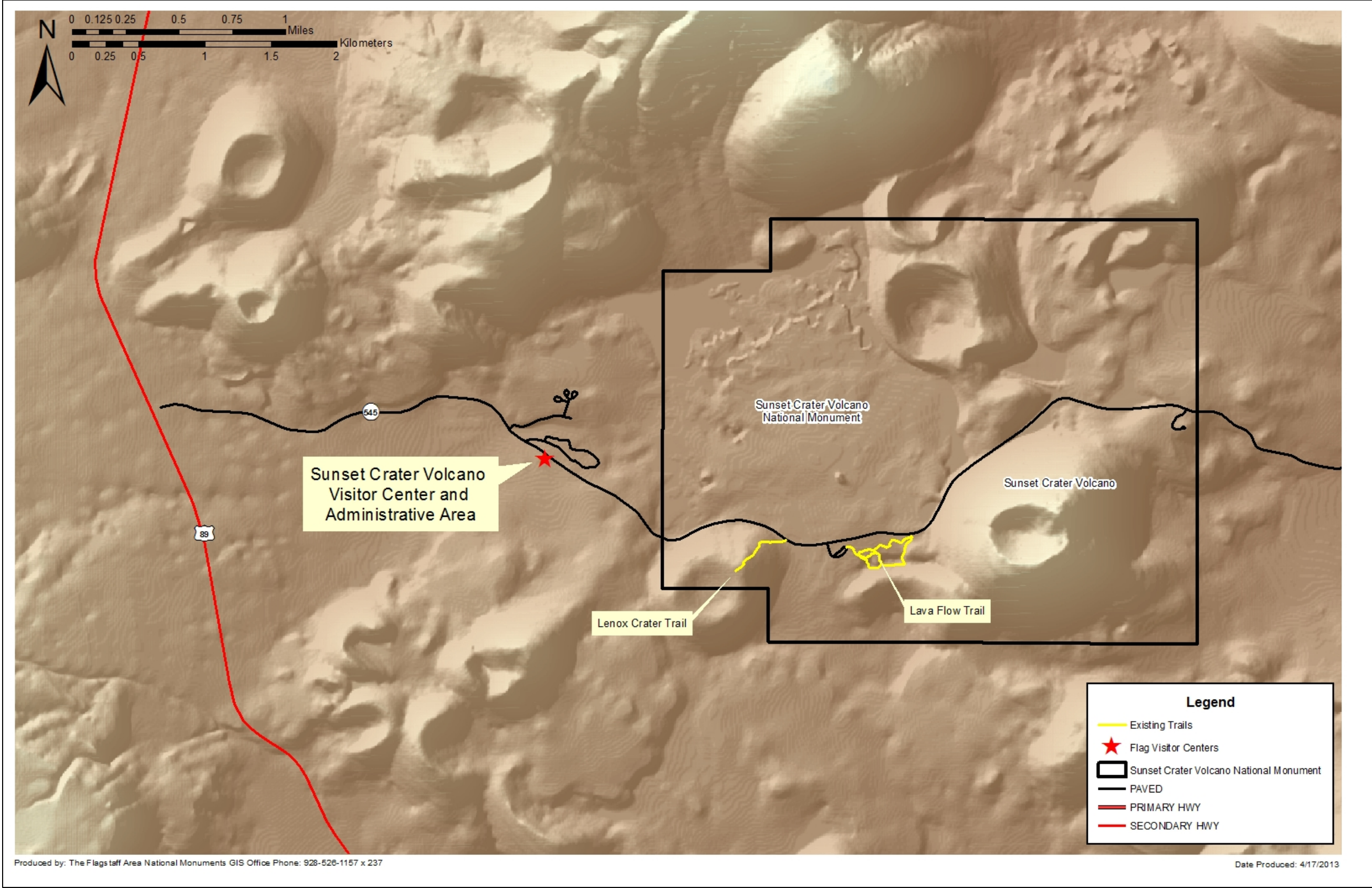


Figure 2. Sunset Crater Volcano National Monument with Existing Facilities.

## Background

The Monument is a popular destination for school groups, tourists en route to the Grand Canyon and Utah, researchers, and recreation groups. This confluence of people results in over 180,000 visitors coming to the monument each year (NPS; <https://irma.nps.gov/Stats>). Projected increases in visitation at the monument and the growing demand for activities have resulted in a number of challenges protecting monument resources. Some challenges facing monument staff include protecting unique volcanic landscapes, vegetation, and cultural resources in sensitive resource areas; accommodating a variety of user groups; providing safe parking and trailhead access in key areas; and locating new trails in appropriate areas that could provide access to less visited areas of the monument. Overcrowding is common on the 1.3 miles of current trails, discouraging non drive-through recreation. Monument visitors often complain of insufficient recreational activities, and monument staff experience difficulty in routing and timing the arrival for multiple school groups in a single day.

The monument has two hiking trails for visitor use, the Lava Flow Trail and the Lenox Crater Trail. The Lenox Crater trailhead is located one-mile east of the Visitor Center (Figure 2). The trail begins on the south side of Forest Road 545 (FR545) and climbs at an average angle of 15 degrees to the rim of the cinder cone. The top of Lenox Crater provides a view into the cinder cone and views of the San Francisco Peaks. Lenox Crater is the only cinder cone within the monument visitors are allowed to climb.

The Lava Flow Trail is located 1.5 miles east of the Visitor Center (Figure 2). The trailhead includes a large parking lot with picnic tables and restroom facilities. The Lava Flow Trail is the most heavily used trail in the monument. The one-mile loop trail skirts the base of Sunset Crater Volcano and loops through the associated lava field, providing spectacular views of the associated geologic features and the Bonito Lava Flow. Portions of the trail are a hardened concrete surface providing Americans with Disabilities Act (ADA) accessibility. Other sections of trail are comprised predominately by the native cinder terrain.

## Purpose and Need

This Trail Plan and General Management Plan (GMP) amendment would address the need to modify the current management zones (Figure 3) at the monument outlined in the GMP (2002) while providing a diverse experience for visitors and protecting the sensitive cultural and natural resources within the monument. This EA will not address any boundary modifications. Since finalizing the GMP (2002), the public and monument staff have steadily expressed the desire for more diverse recreational activities in the monument. Current conditions at the monument inhibit most forms on non-vehicular sightseeing. From the Visitor Center and nearby Bonito Campground, visitors and campers must travel by vehicle to the Lenox Crater Trail and Lava Flow Trail to explore the monument, which are only about 1 ½ miles away. This increases fossil fuel use and greenhouse gas emissions into the environment. In addition, the existing trail leading to the top of Lenox Crater was not well-planned, and currently traverses nearly straight up the steep slope instead of being laid out with switchbacks at more gentle angles. As a result, in places the trail has eroded into a gully that is over two feet deep fully exposing the roots of ponderosa pine trees causing them to be damaged. Lastly, visitors are currently not able to experience a greater degree of solitude and natural quiet because most existing use areas are adjacent to the road and parking areas, where motor vehicles are frequently audible.

Since the GMP (2002) was finalized, the NPS has completed a thorough survey and detailed map of the volcanic features within the monument. A framework for characterizing and monitoring the

ALTERNATIVES

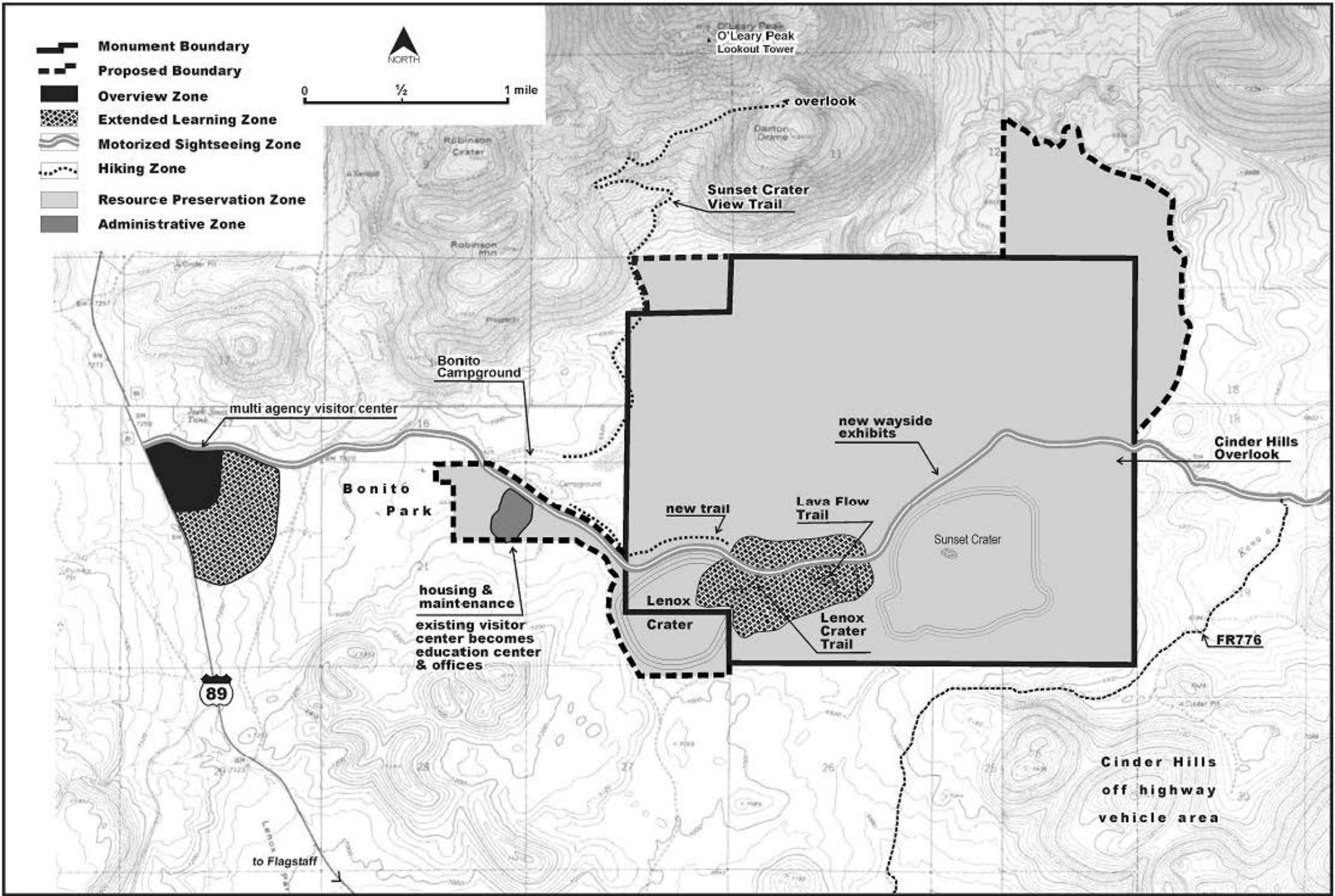


Figure 3. Extracted Map from the GMP (2002) Preferred Alternative.

condition of the most unique and fragile volcanic features was developed as part of this effort. This inventory identified certain volcanic features that are important to explaining the eruption of Sunset Crater Volcano; however, many of these features occur outside of the Extended Learning Zone identified in the GMP (2002). Other than first-hand experience, it would be very difficult to incorporate these features into monument interpretative programs.

Currently being developed is a baseline assessment of off-trail trampling impacts in barren cinder terrain. In 1998, the monument's backcountry was closed to the public. This closure has given resource specialists the ability to estimate the rate of recovery in the cinder landscape from prior off-trail use. Observations from these assessments indicate areas of barren cinder terrain in relatively level ground show very little residual evidence of off-trail activity. However, evidence of off-trail use on slopes steeper than 14 degrees is still present. These observations show the need to manage visitor use to prevent traversing on slopes greater than 14 degrees.

The NPS has also completed a 100 percent inventory of historic properties and cultural resources within the monument (Downum 2009). Typical historic properties near the project area consist of historic artifact scatters, raised railroad and road alignments, and isolated occurrences of prehistoric artifacts. A site specific survey was completed in October 2012 and identified no historic properties or cultural resources within the area of potential effect for this project. Ethnographic consultations were conducted with tribes traditionally associated with the monument and traditional cultural properties have been identified and occur outside of the project area. Archeological monitoring is ongoing at the monument and condition assessments are completed annually.

Results from these extensive natural and cultural inventories ensure visitor access and activities can readily be accommodated without increasing impacts to these resources. The new trail design, self- and ranger-guided hiking opportunities, and day-use facilities would allow for increased non-motorized recreation by improving connectivity between the Visitor Center, Bonito Campground, and popular visitor use areas in the monument while preserving the important resources at the monument.

The GMP (2002) was predicated by the designation of the majority of the monument being off-limits and managed solely for resource preservation. To the credit of the GMP planners, many resources in the monument remain in pristine conditions. However, insufficient access to popular features encourages illicit off-trail travel resulting in increases in resource damage. To mitigate resource damages, established trails and zones would guide people to attractions while monitoring protocols would track long-term effects of human and natural forces on unique geological formations.

The GMP (2002) addressed concerns regarding the balance between resource protection and visitor uses. When identifying methods to protect the various uses at the monument, the GMP Team with public involvement defined eight possible management zones applicable to the monument. Only five of these zones are relevant to the scope of this EA (Table 1). Approximately 94% of the monument was identified as a Resource Preservation Zone and the remaining 6% was classified as an Extended Learning Zone, a Motorized Sightseeing Zone and Hiking Zone. The Motorized Sightseeing Zone, Administrative Zone (outside of the monument boundaries), and Overview Zone would not be modified under this plan and will be dismissed from further discussion. This proposal will analyze the effects of reducing the size of the Extended Learning Zone, modifying and expanding the Hiking zone, and creating a Guided Adventure Zone.

In summary, the following objectives would be met with this trail plan, GMP amendment, and Environmental Assessment:

- Establish an interconnected and fully integrated hiking trail system
- Develop sustainable trail designs that are appropriate for the landscape
- Expand the existing hiking trail system
- Increase non-motorized recreational opportunities for monument visitors
- Eliminate unnecessary and duplicate hiking trails

Table 1. Resource Management Zone Definitions Extracted from the GMP (2002).

Zone	Resource Condition or Character	Visitor Experience	Appropriate Kinds of Activities or Facilities
<b>Resource Protection Zone</b>	Resources in this area are fragile and may be in a range of condition from pristine to endangered. Management actions for resource protection would be high, and tolerance for resource degradation would be very low.	Access to these areas would be restricted and permitted only for the purposes of research, tradition cultural activities, or other well-justified special uses. The areas would provide maximum preservation of fragile and/or unique resources, endangered species, sacred sites, and so on. Although access would be restricted, visitors could benefit from the experience of learning that particularly sensitive resources are preserved for future generations.	There would be no facilities or developments for visitors, but off-site interpretation would be extensive, to promote visitor education about the value of resource protection. As noted, access would be by permit only for approved activities. Telecommunication infrastructure would not be permitted in this zone.
<b>Discovery Zone</b>	Resources would appear pristine. On-site controls and restrictions would be minimal and subtle. The tolerance for resource modifications and degradation would be very low.	Visitors would explore remote areas in a wilderness-like setting, free from modern intrusions. These areas could be trailed or untrailed. Trails would be primitive in nature (unsurfaced and no wider than 2 feet), and no other facilities would be present. Solitude, natural soundscape, and undirected discovery would be key to this experience. Opportunities for independence, closeness to nature, challenge, and adventure would be common, and visitors would need to have individual outdoor skills and be self-sufficient. There would be a very low probability of encountering other visitors or evidence of visitor impacts. Off-site management of visitors could include eligibility requirements before entering such an area, and limits on numbers of visitors and length of stay could be in place.	No facilities except for primitive trails would be appropriate in these areas. Cross-country hiking would be the predominant activity. Telecommunication infrastructure would not be permitted in this zone.
<b>Extended Learning Zone</b>	Visitors, sites, and trails would be intensively managed to ensure resource protection and public safety. Areas would be predominately natural, but the sights and sounds of people would be evident. Resources could be modified for essential visitor needs (such as trails and interpretive media) and park operation needs (such as hardening of archeological sites), but they would be changed in a way that harmonizes with the natural and cultural environment. Except for essential changes, the Park Service’s tolerance for resource degradation would be low.	The emphasis in this experience would be on visiting and learning about significant park resources. These experiences could be either self-guided or ranger-led. Intimate interaction with resources would be offered where possible without undue resource impacts. Structure and direction would be provided, (e.g., trails, interpretive media, signs), but some opportunities for discovery would also be available. Visitors would need to exert some physical effort and make at least a moderate time commitment. At certain times of the day or season there could be opportunities for solitude, but in general there would be a moderate probability of encountering other visitors. The probability of encountering park staff and other evidence of NPS management would be high.	Trails (which could be surfaced and up to 5 feet wide), overlooks, and wayside exhibits and other interpretive media would be appropriate in these areas. Support facilities, such as rest rooms and small picnic areas, could also be present. Predominant activities would include hiking, viewing resources, and attending interpretive walks and talks. Telecommunication infrastructure would not be permitted in this zone.
<b>Guided Adventure Zone</b>	Resources in these areas would appear pristine. Low levels of management for resource protection and visitor safety would be appropriate in these areas, but any resource modifications would be minimal and would harmonize with the natural environment. Tolerance for resource degradation in these areas would be low.	Visitors would explore park resources as part of a guided group. Areas where this experience would be offered would usually be untrailed and free from developments. Intimacy with resources, learning, social interaction among the group, and the security of a guided experience would be key elements of this experience. The probability of encountering other groups would be low, and there would be some opportunities for individual solitude. The environment would offer a moderate level of challenge, but the need for individual outdoor skills would be low.	No permanent facilities would be appropriate in these areas except for primitive trails if deemed necessary for resource protection. Hiking and camping with a guide would be the predominant activity in these areas. Telecommunication infrastructure would not be permitted in this zone.
<b>Hiking Zone</b>	Resources would appear pristine. On-site controls and restrictions would be used if needed for resource protection. The tolerance for resource modifications and degradation would be low.	Visitors would explore the park using unpaved trails. Trails would be semiprimitive (unsurfaced and no wider than 4 feet), and few other facilities would be present. Visitors would need to make a moderate time commitment. There would be a low probability of encountering NPS staff and a moderate probability of encountering other visitors or evidence of visitor impacts. Off-site management of visitors could include eligibility requirements before entering such an area, and limits on numbers of visitors and length of stay could be in place.	Few facilities except for trails, trailheads, occasional pit toilets, and minimal interpretation would be appropriate in these areas. Hiking would be the predominant activity. Telecommunication infrastructure would not be permitted in this zone.

## Relationship to Other Plans and Policies

The proposed action remains consistent with the following plans and policies:

- The GMP (2002) analyzed operational efficiency, which is the ability to adequately protect and preserve vital monument resources and provide for a pleasurable visitor experience. Trails that are used to facilitate recreational experiences in the monument are included under this section. The upgrading and expansion of the trail system would be able to meet the expected increases in visitation and the need to improve the monuments recreational opportunities.
- The Coconino National Forest Plan (1987), as amended, and Flagstaff/Lake Mary Ecosystem Analysis (FLEA) amendment, addresses recreational activities and facilities that are to meet visitor needs and be consistent with ecological goals and recreational objective. This EA is consistent with the overall management directions and specific management requirements of the FLEA amendment.
- The proposal is consistent with the goals and objectives of the *National Park Service Management Policies 2006* that states that “trail design will vary to accommodate a wide range of users and be appropriate to user patterns and site conditions.” In addition, this proposal conforms to the standards found for parking areas. In the *Management Policies*, it states that “parking areas and overlooks will be located to not unacceptably intrude, by sight, sound, or other impact, on park resources or values.”
- The Flagstaff Area National Monuments Five Year Strategic Plan (2013-2017) calls for the expansion of visitor facilities; including trails and amphitheaters.

## Scoping

Scoping is a process to identify the resources that may be affected by a project proposal, and to explore possible alternative ways of achieving the proposal while minimizing adverse impacts. Internal scoping was completed with appropriate National Park Service staff, as described in more detail in the *Consultation and Coordination* chapter. The monument also conducted external scoping with the public, interested/affected groups, and Native American communities.

External scoping was initiated with the distribution of a scoping letter to inform the public of the proposal to construct a new trail system, and to generate input on the preparation of this Environmental Assessment. The scoping letter dated February 9, 2012 was mailed to 59 recipients. In addition, it was mailed to various federal and state agencies, associated Native American tribes, local governments, and local news organizations. Scoping information was also posted on the monument’s Planning, Environment, and Public Comment (PEPC) website.

During the initial 30-day scoping period, one public response was received. The respondent was neutral about the construction of a new trail system. In addition, during tribal consultation, one Native American tribe responded with no objection to the proposed project and requested to be kept informed of the project’s progress. On February 27, 2013, an additional letter was sent to the tribes traditionally associated with the monument as alternatives were developed to acquire additional feedback. Two tribes responded; one indicating no concerns and one requesting an administrative meeting to discuss the project further. More information regarding external scoping and Native American consultation can be found in *Comments and Coordination* chapter.

## Impact Topics Retained for Further Analysis

Impact topics for this project were identified on the basis of federal laws, regulations, and orders; 2006 *Management Policies*; and National Park Service knowledge of resources at Sunset Crater

Volcano National Monument. Impact topics that are carried forward for further analysis in this Environmental Assessment include:

- Geologic Resources and Soil
- Vegetation
- Wildlife
- Special Status Species
- Aesthetics
- Visitor Use and Experience

## Impact Topics Dismissed From Further Analysis

In this section, the NPS takes a “hard look” at all potential impacts by considering the direct, indirect, and cumulative effects of the proposed action on the environment, along with connected and cumulative actions. Impacts are described in terms of context and duration. The context or extent of the impact is described as localized or widespread. The duration of impacts is described as short-term, ranging from days to three years in duration, or long-term, extending up to 20 years or longer. The intensity and type of impact is described as negligible, minor, moderate, or major, and as beneficial or adverse. The NPS equates “major” effects as “significant” effects. The identification of “major” effects would trigger the need for an EIS. Where the intensity of an impact could be described quantitatively, the numerical data are presented; however, all impact analyses are qualitative and use best professional judgment in making the assessment.

The NPS defines “measurable” impacts as moderate or greater effects. It equates “no measurable effects” as minor or less effects. “No measurable effect” is used by the NPS in determining if a categorical exclusion applies or if impact topics may be dismissed from further evaluation in an EA or EIS. The use of “no measurable effects” in this EA pertains to whether the NPS dismisses an impact topic from further detailed evaluation in the EA. The reason the NPS uses “no measurable effects” to determine whether impact topics are dismissed from further evaluation is to concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail in accordance with CEQ regulations at 1500.1(b).

In this section of the EA, NPS provides a limited evaluation and explanation as to why some impact topics are not evaluated in more detail. Impact topics are dismissed from further evaluation in this EA if:

- they do not exist in the analysis area, or
- they would not be affected by the proposal, or the likelihood of impacts are not reasonably expected, or
- through the application of mitigation measures, there would be minor or less effects (i.e. no measurable effects) from the proposal, and there is little controversy on the subject or reasons to otherwise include the topic.

Due to there being no effect or no measurable effects, there would either be no contribution towards cumulative effects or the contribution would be low. For each issue or topic presented below, if the resource is found in the analysis area or the issue is applicable to the proposal, then a limited analysis of direct and indirect, and cumulative effects is presented.

## Water Resources

NPS policies require protection of water quality consistent with the Clean Water Act (1972), as amended. The purpose of the Clean Water Act is to “restore and maintain the chemical, physical, and biological integrity of the Nation's waters.” To enact this goal, the U.S. Environmental Protection Agency has delegated the authority to the Arizona Department of Environmental Quality

to evaluate discharges into waters of the United States, and issue permits for actions consistent with the Clean Water Act.

The monument and surrounding area is dominated by a volcanic landscape of porous and fractured basalt from lava flows, which are interbedded with deep deposits of unconsolidated cinder, scoria, and ash. These deposits are more than 1,000 feet deep and are highly permeable. All precipitation either evaporates at the surface or rapidly percolates deep into the ground. There are no seeps, springs, or ephemeral drainages within the monument. Surface water only occurs from stormwater temporarily accumulating within small depressions on top of the Bonito Lava Flow. Based upon a records from a water well drilled west of the monument Visitor Center, the shallowest groundwater within the area is approximately 1,900 feet deep in the Regional Coconino Aquifer (Christensen 1982). This aquifer is among the primary sources of water for the City of Flagstaff. Water for the neighboring communities immediately outside the town limits, including the monument Visitor Center and administrative area, is provided by Doney Park Water Company, which operates wells developed in the Coconino Aquifer. The water quality data inventory and analysis (NPS 1996) found no water quality data records for the monument (NPS 1996). The proposed trail system would not be located in the vicinity of any regulated surface waters. Since the water resources are limited at the monument and the aquifer is deep, impacts to water resources would be negligible; thus, this topic is dismissed from further analysis.

### **Wetlands, Floodplains, and Riparian Areas**

For regulatory purposes under the Clean Water Act (1972) the term wetlands means "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." There are no seeps, springs, or ephemeral drainages within the monument. Surface water only occurs temporarily following storm events in small depressions in solid rock on top of the Bonito Lava Flow. The vegetation along the edge of the Bonito Lava Flow may derive some extra water in the form of seepage through the lava bed. Certain plants, including aspen trees and desert olive shrubs are more prevalent here, but there is no measurable water, nor do wetland plant species or wetland soils occur anywhere within the monument.

Executive Order 11990 *Protection of Wetlands* requires federal agencies to avoid, where possible, adversely impacting wetlands. Further, Section 404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers to prohibit or regulate, through a permitting process, discharge of dredged or fill material or excavation within waters of the United States. NPS policies for wetlands as stated in *2006 Management Policies* and Director's Order 77-1 *Wetlands Protection*, strive to prevent the loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In accordance with DO 77-1 *Wetlands Protection*, proposed actions that have the potential to adversely impact wetlands must be addressed in a Statement of Findings for wetlands. No areas within the monument meet the criteria for jurisdictional wetlands, and the proposed trails and related infrastructure would require no excavation or fill in any area resembling a wetland or drainage channel. No adverse impacts to wetlands as described in DO 77-1 are expected. Therefore, no Statement of Findings will be prepared and the topic of wetlands was dismissed from further analysis.

Executive Order 11988 *Floodplain Management* requires all federal agencies to avoid construction within the 100-year floodplain unless no other practicable alternative exists. The NPS guided by the *2006 Management Policies* and Director's Order 77-2 *Floodplain Management* will strive to preserve floodplain values and minimize hazardous floodplain conditions. According to Director's

Order 77-2 *Floodplain Management*, certain construction within a 100-year floodplain requires preparation of a Statement of Findings for floodplains. No areas within the monument are functioning floodplains within active drainage channels. Development of the proposed trails and related visitor use infrastructure would require no excavation or fill in any area resembling a floodplain or active drainage channel, and would only very locally affect stormwater runoff within an entirely upland environment. Therefore, a Statement of Findings for floodplains will not be prepared. Therefore the topic of floodplains was dismissed from further analysis.

## Historic Resources

The term “historic structures” refers to both historic and prehistoric structures, which are defined as constructions that shelter any form of human habitation or activity. The monument Visitor Center Complex Historic District is eligible to be listed on the National Register, because it is an “exceptional example of NPS Mission 66 planning and park service modern architecture,” (NPS 2008). Some ground disturbance would occur from the proposed trail construction within the Visitor Center Complex Historic District. The proposed action would cause negligible visual changes. However, the proposed action would benefit the historic resources by reducing off-trail travel. No prehistoric structures or sites were located within the area of potential effect (Kleinman 2012). Impacts to historic resources would be negligible, thus historic resources were dismissed from further analysis.

## Ethnographic Resources

Director’s Order 28 (DO-28), *Cultural Resource Management*, defines ethnographic resources as any site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of an associated traditional group. According to DO-28 and Executive Order 13007, *Indian Sacred Sites*, the NPS should preserve and protect ethnographic resources. There are no known ethnographic resources within the proposed project area. The proposed trail system would be designed to minimize any impacts to natural resources and to restore native plant communities that could be identified as ethnographic resources. However, the proposed project would have negligible effects on ethnographic resources, thus ethnographic resources was dismissed from further analysis.

## Paleontological Resources

The *National Park Service Management Policies 2006* states the paleontological resources (fossils), including both organic and mineralized remains in body or trace form, will be protected, preserved, and managed for public education, interpretation, and scientific research. The geologic condition at the monument is formed by very recent volcanic deposits with limited post eruption of alluvial, colluvial, and aeolian processes that are not conducive to the preservation of paleontological resources. Therefore, there would be no likely impacts to paleontological resources as a result of the proposed project and the topic was dismissed from further assessment.

## Museum Collections

The Director’s Order 24 *Museum Collections* states that NPS is required to consider the impacts on museum collections (historic artifacts, natural specimens, and archival and manuscript material), and provides further policy guidance, standards, and requirements for preserving, protecting, documenting, and providing access to, and use of, NPS museum collections. No monument museum collection items would be disturbed as a result of this project. Therefore, museum collections were dismissed from further analysis.

## Park Operations

Monument operations include changes that may affect the current facilities or that may require a new level of maintenance or staffing. The proposed action would improve the current trail system and reduce the potential level of maintenance for hiking trails in the monument to normal cyclic schedules. Some ranger presence would be needed to patrol or lead visitor on interpretive hikes, but would only cause negligible impacts to staff duties. The proposed action would not significantly change overall park operations, but would enable the monument to provide increased recreational activities. Therefore, park operations were dismissed from further analysis.

## Air Quality

The Clean Air Act of 1963 (42 U.S.C. 7401 *et. seq.*) established federal programs that provide special protection for air resources and air quality related values associated with NPS units. Specifically, Section 118 of the Clean Air Act requires a park unit to meet all federal, state, and local air pollution standards. The monument is designated as a Class II air quality area under the Clean Air Act, which means emissions of particulate matter and sulfur dioxide are allowed up to the maximum increase in concentrations of pollutants over baseline concentrations as specified in Section 163 of the Clean Air Act. In addition, the Clean Air Act gives the federal land manager the responsibility to protect air quality related values (i.e., visibility, plants, animals, soils, water quality, cultural resources, and visitor health) from adverse pollution impacts.

Motor exhaust and fugitive dust caused by mechanical equipment used during the trail system construction would be negligible and temporary. The Class II air quality designation would not be affected by the project. Therefore, air quality was dismissed as an impact topic for further analysis.

## Soundscape Management

In accordance with the *National Park Service Management Policies 2006* and Director's Order 47 *Sound Preservation and Noise Management*, an important component of the NPS's mission is the preservation of natural soundscapes associated with national park units. Natural soundscapes exist in the absence of human-caused sound. The natural ambient soundscape is the combination of all the natural sounds that occur in park units, together with the physical capacity for transmitting natural sounds. The frequencies, magnitudes, and durations of human-caused sound considered acceptable varies among NPS units as well as potentially throughout each monument, being generally greater in developed areas and less in undeveloped areas.

Impacts to the soundscape could occur from equipment (e.g., backhoe) used for trail construction. These impacts should be minor and temporary and should not exceed typical levels of man-made noise present during visitor season. Therefore, soundscape management was dismissed as an impact topic for further analysis.

## Lightscape Management

The *National Park Service Management Policies 2006* states the NPS will strive to preserve natural ambient landscapes, which are natural resources and values that exist in the absence of human caused light. The monument strives to limit the use of artificial outdoor lighting to the amount necessary for basic safety requirements. Under the proposed alternatives, no new lighting or infrastructure producing light would be installed. Therefore, no impacts to lightscape management; thus, this topic was dismissed from further analysis.

## Socioeconomics

The proposed action would neither change local and regional land use nor appreciably impact local businesses or other agencies. There could be minimal increases in employment opportunities and revenue generated in nearby small businesses from implementation of the proposed action. Any increase in workforce and revenue would be temporary and negligible. Because the impacts to the socioeconomic environment would be negligible, this topic was dismissed from further analysis.

## Prime and Unique Farmlands

The Farmland Protection Policy Act of 1981, as amended, requires federal agencies to consider adverse effects to prime and unique farmlands that would result in the conversion of these lands to non-agricultural uses. Prime or unique farmland is classified by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS). Prime farmland is defined as land that has the best combination of physical and chemical properties for producing food, forage, fiber, and oil seed, and for other uses (e.g., pasture land, forest land, and crop land). Unique farmland is defined as land other than prime farmland that can produce high value and fiber crops, such as fruits, vegetables, and nuts. There are no prime and unique farmlands designated in the monument, thus this topic was dismissed from further analysis.

## Indian Trust Resources

Secretarial Order 3175 mandates any anticipated impacts to Indian trust resources from proposed project or action by the Department of Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. There are no Indian trust resources in the monument. Therefore, the project would have negligible effects on Indian trust resources, and was dismissed from further analysis.

## Environmental Justice

Executive Order 12898 *General Actions to Address Environmental Justice in Minority Populations and Low-income Populations* requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minorities and low-income populations and communities. The proposed action would not have disproportionate health or environmental effects on minorities or low-income populations or communities. Therefore, environmental justice was dismissed from further analysis.

## Wilderness

The Wilderness Act of 1964 established the National Wilderness Preservation System to "...secure for the American people of present and future generations the benefits of an enduring resource of wilderness." Furthermore, the Wilderness Act states that "in order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness." Although there is great similarity between the NPS Organic Act and the Wilderness Act, Congress applied the Wilderness Act to NPS to strengthen its protective capabilities.

The *National Park Service Management Policies 2006*, Section 6 states, “The National Park Service will evaluate all lands it administers for their suitability for inclusion within the national wilderness preservation system. For those lands that possess wilderness characteristics, no action that would diminish their wilderness suitability will be taken until after Congress and the President have taken final action. The superintendent of each park containing wilderness will develop and maintain a wilderness management plan to guide the preservation, management, and use of the park’s wilderness area, and ensure that wilderness is unimpaired for future use and enjoyment as wilderness.”

The purpose of Director’s Order-41, Wilderness Preservation and Management, is to provide accountability and consistency to NPS’ wilderness management program and to guide NPS’ efforts in meeting the letter and spirit of the 1964 Wilderness Act. DO-41 should be applied to management actions carried out within the framework of a park’s general management plan, the Government Performance and Results Act, a park’s natural and cultural resource plans, and the park’s wilderness management plan.

There are no lands designated as wilderness in the monument, nor is there any sizeable road-less areas within the monument or on adjacent CNF lands. Thus, wilderness was dismissed from further analysis.

### **Invasive Plant Species**

There are no federal laws governing vegetation in general; however, NPS has developed policies and guidance on vegetation management. Section 4.4 of the *National Park Service Management Policies 2006* addresses biological resource management, including management of native plants and animals. This policy states that NPS will maintain all native plants as parts of the natural ecosystems of parks. Management practices to limit potential impacts to vegetation vary amongst NPS units. However, parks generally have management practices to minimize potential impacts to vegetation and to protect sensitive vegetation resources.

There is a risk of invasive species introduction and spread associated with any construction, increased visitation, or ground disturbing activity. However, the proposed action would result in a relatively small area of disturbance. There are sufficient mitigating measures, including inspection of fill materials to ensure they are free of noxious species, to reduce the potential for introduction of new invasive plants. The NPS actively monitors for problem species around the monument and facility areas, and has staff dedicated to the control and removal of problem species if they are introduced. Therefore, invasive plants were dismissed from further analysis.

## ALTERNATIVES

In March 2012 and January 2013, an interdisciplinary team of National Park Service employees met for the purpose of developing project alternatives. These meetings resulted in the definition of project objectives as described in the *Purpose and Need*, and a list of alternatives that could potentially meet these objectives. A total of four action alternatives and the no-action alternative were originally identified for this project. Of these, two of the action alternatives were dismissed from further consideration for various reasons, as described later in this chapter. Two action alternatives and the no-action alternative are carried forward for further evaluation in this EA. Summary tables comparing alternative components are presented at the end of this chapter.

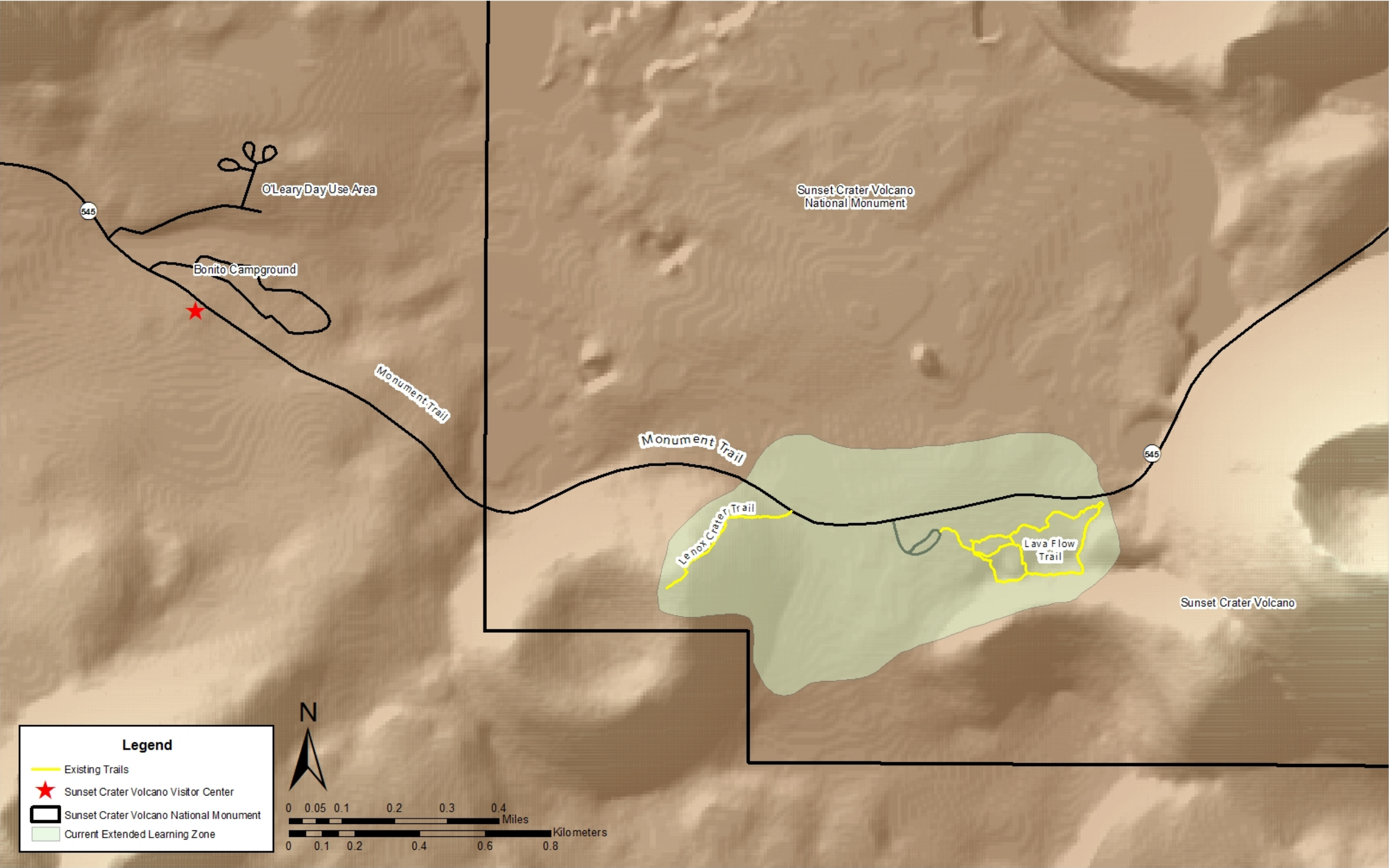
### Alternatives Carried Forward

#### Alternative A – No Action Alternative

Under this alternative, the trail system would not be constructed. The existing trail system would not change and current hiking trails would remain in their present location. Should the no-action alternative be selected, the National Park Service would respond to future needs and conditions of visitor experiences without major actions or changes in the present course of action. See Figure 4 for a map of the existing conditions.

Key Actions under Alternative A:

- Continued self-guided visitor access on the existing Lava Flow Trail and the Lenox Crater Trail within the Extended Learning Zone.
- Resource degradation in the form of cinder soil erosion, rutting, and tree root exposure would continue on the Lenox Crater Trail.
- Visitors would continue to be limited to vehicle only access to the Lenox Crater and Lava Flow Trails, and would not be able to visit the Monument by hiking from the Visitor Center or Bonito Campground.
- Visitors would not be provided opportunities for ranger-guided hikes to learn about key volcanic features that are currently within the Resource Preservation Zone.



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Figure 4. Alternative A -- Existing Conditions

## Alternative B – GMP Trail Implementation

This alternative would implement the hiking trails proposed in the 2002 General Management Plan (GMP). The GMP (2002) called for the construction of a trail from Bonito Campground to the Lava Flow Trail. See Figure 5 for a map of this alternative.

Key Actions under Alternative B:

- A new hiking trail, approximately 1.2 mile in length (0.4 miles on the Coconino National Forest and 0.8 miles on NPS), would be constructed. It would start near the Bonito Campground, and enter the monument near the southwestern corner. From there it parallels the Scenic Loop Road to the Lenox Crater Trailhead and then to the Lava Flow Trail.
- Within the monument, approximately 0.5 miles of the trail would be within the existing GMP Hiking Zone and 0.2 miles within the GMP Extended Learning Zone.
- Access to the trails and parking areas would remain the same. Visitors would access the trail and Extended Learning Zone from the Bonito Campground and Visitor Center, the Lenox Crater pull-out area or the Lava Flow Trail parking area.
- The NPS is currently cooperating with the United States Forest Service to plan and implement the connector trail on the Coconino National Forest. All trails located on the Coconino National Forest are approximate and would be finalized in a separate NEPA analysis by the United States Forest Service. The proposed trail corridor would connect the Bonito Campground to the proposed NPS trail that parallels the park entrance road north of Lenox Crater.

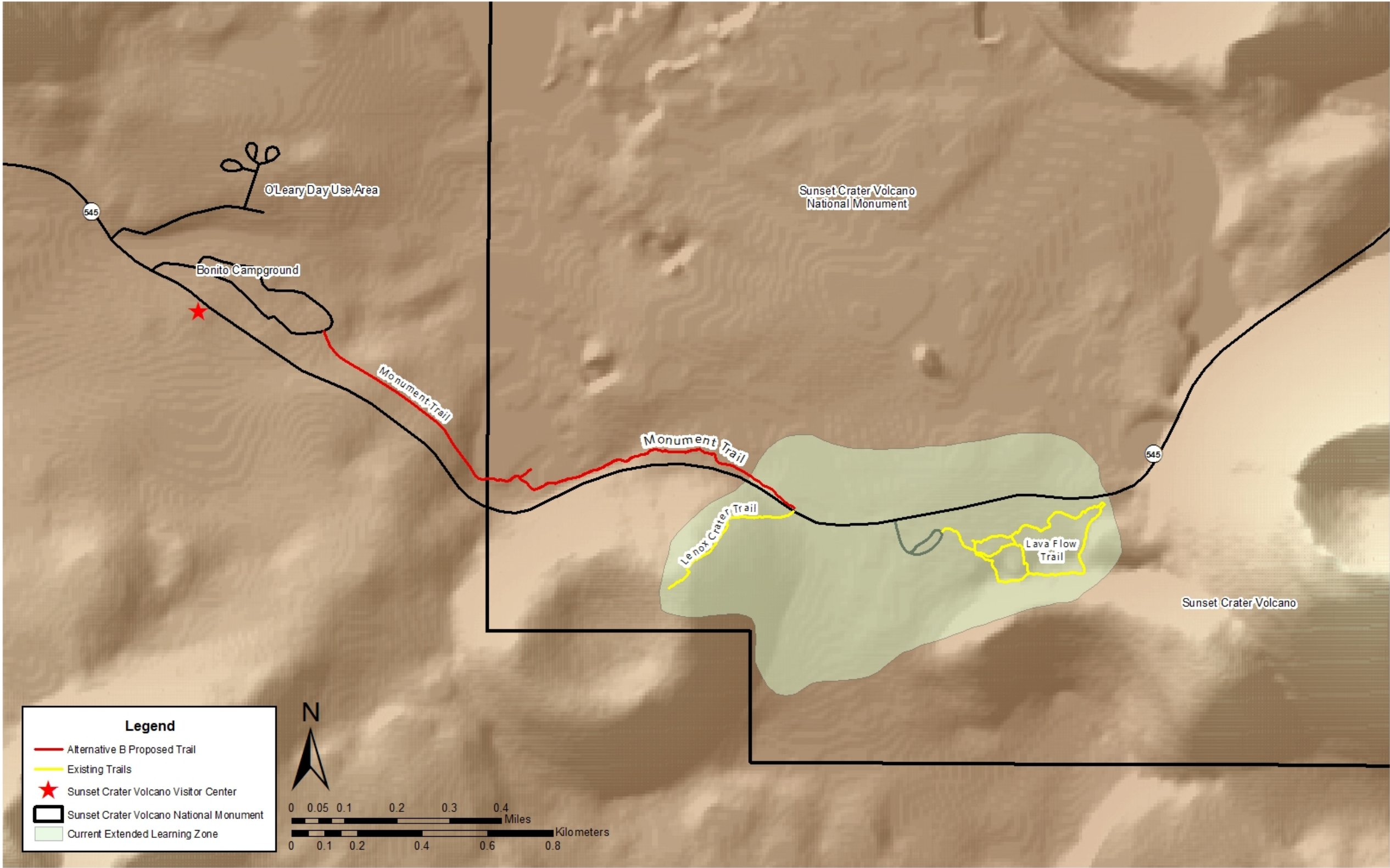


Figure 5. Alternative B – GMP Trail Implementation

## Alternative C – Trails and GMP Amendment (Preferred Alternative)

This alternative (Figure 6) consists of constructing approximately 3.2 miles of new hiking trails within the monument boundary and the obliteration and naturalization of the current Lenox Crater Trail (0.3 miles). Because some activities identified in this alternative fall outside the scope and definitions of zones in the General Management Plan (2002), this alternative introduces modifications to GMP zoning using updated scientific information previously unavailable.

Significant changes from the GMP (2002) include: reduction of acreage for the Extended Learning Zone, the establishment of a Guided Adventure Zone, and the identification of new Hiking Zones. Since the creation of the GMP, detailed volcanic feature inventory and mapping has been completed, along with the acquisition of high-resolution digital maps of steep volcanic cinder terrain. Lastly, a project is underway to map and document the effects of past and ongoing recreational activities on the volcanic resources within the monument. Archeological surveys have also been completed. The NPS is now able to apply a considerable amount of new information on the monument's geologic and cultural resources for site-specific planning to provide for new visitor access and activities, while protecting and preserving the most unique volcanic eruption features and fragile volcanic cinder terrain within the monument. The new planning information also provides an accurate baseline for long term monitoring of resource conditions and visitor impacts and can be utilized to adjust the proposed new visitor access and activities should impacts exceed planning thresholds.

The NPS is currently cooperating with the United States Forest Service to plan and implement key connector trails on the Coconino National Forest. Two proposed trail corridors have been tentatively identified – one would connect the Bonito Campground to the proposed NPS trail that parallels the park entrance road north of Lenox Crater. The other would connect to the new trail system within the monument to provide a return loop around the southern side of Lenox Crater to the Visitor Center (approximately 2.0 miles). All trails located on the Coconino National Forest are approximate and would be finalized in a separate NEPA analysis by the United States Forest Service.

In addition, the creation of a Guided Adventure Zone north of the Scenic Loop Road and Sunset Crater Volcano would be identified. Visitors would explore monument resources within this zone as part of a guided group. Areas where this experience would be offered would usually be untrailed and free from developments. Intimacy with resources, learning, social interaction among the group, and the security of a guided experience would be key elements of this experience. No permanent facilities would be appropriate in these areas except for primitive trails if deemed necessary for resource protection. Hiking with a guide would be the predominant activity in this area.

### Key Actions under Alternative C:

#### *GMP Amendments:*

- Adjust the boundary of Extended Learning Zone to the south side of the Sunset Crater-Wupatki Scenic Loop Road, and extend it westward to encompass more of Lenox Crater.
- Establish a new 92.1 acre Guided Adventure Zone north of the Scenic Loop Road. This new zone encompasses approximately 34.7 acres that were formerly within the Extended Learning Zone and 57.4 acres that were formerly within the Resource Preservation Zone.
- Establish new Hiking Zones to the south and west of the Extended Learning Zone, to accommodate 1.4 miles of new trails.

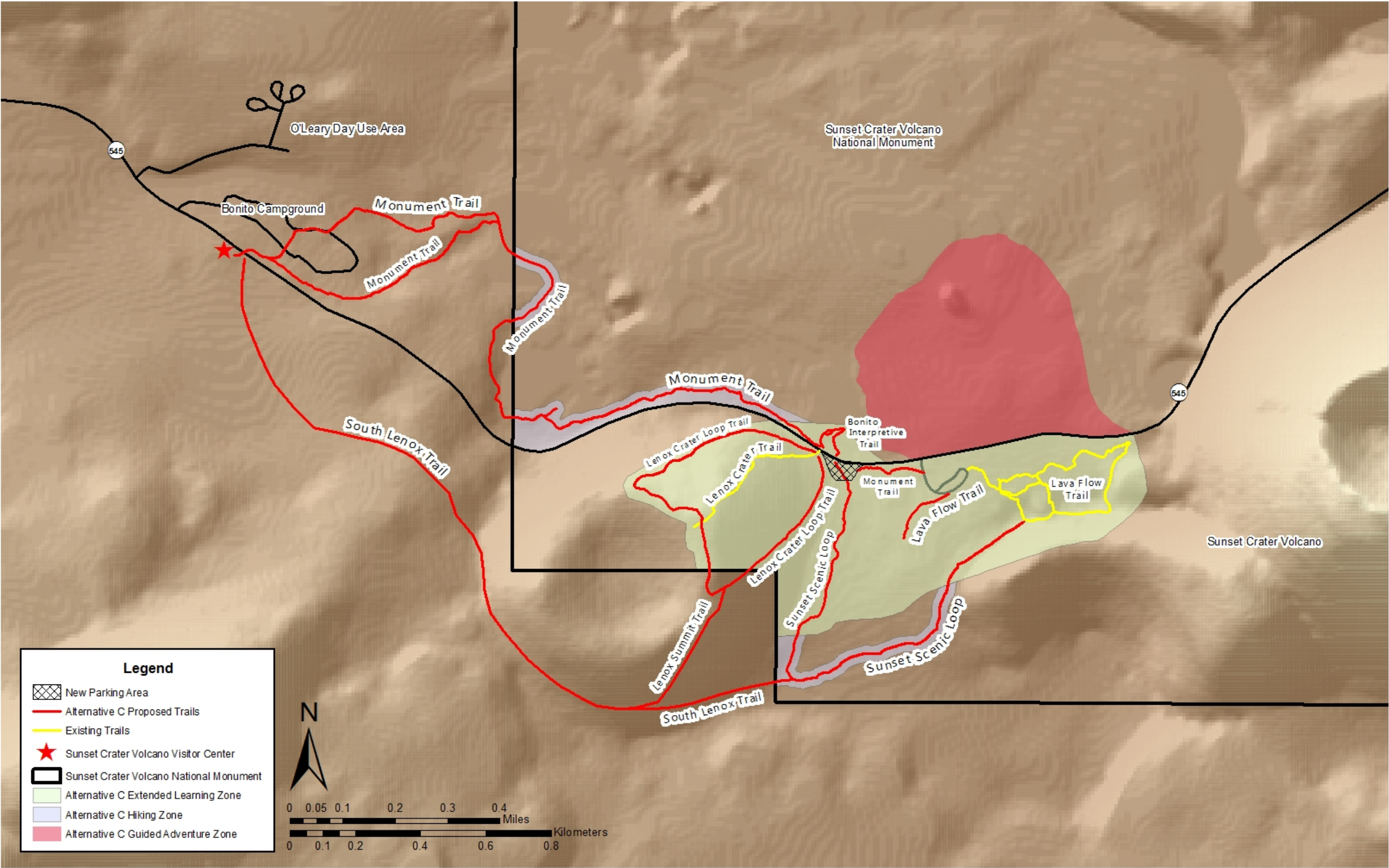


Figure 6. Alternative C -- SUCR Loop Trails and GMP Amendment.

- The overall effect would decrease the Extended Learning Zone by 30 acres, increase the Hiking Zone by 30 acres, create a new 92 acre Guided Adventure Zone, and decrease the Resource Preservation Zone by 92 acres.
- Visitor access within the proposed Guided Adventure Zone would be restricted to NPS staff-guided hikes in groups of 15 or fewer people.
- Discovery hikes will be offered primarily on weekends and holidays from April through October.
- Within the Guided Adventure Zone, visitor access will be prohibited on open cinder slopes with a slope angle greater than 14 degrees. A map has been developed, showing approximately 20 acres of steep cinder slopes to be avoided within the Guided Adventure Zone.
- The NPS will establish a baseline and periodically monitor for impacts to unique volcanic features and cinder terrain within the Guided Adventure Zone. Should evidence from monitoring show that impacts are approaching or exceeding the level of effects under this EA, the NPS will develop and implement additional mitigation, such as reducing or altering visitor access, restoring disturbed areas, and/or periodic closure and rest of discovery hike routes or areas within the Guided Adventure Zone.

*New Trail Construction:*

- Implement one of the "Key Actions" from the GMP by constructing a new trail connecting from the Bonito Campground to the Lava Flow Trail (1.0 miles). The trail would start at the Monument boundary near the southwestern corner and parallel the Scenic Loop Road to the Lenox Crater Trailhead and the Lava Flow Trail.
- Formalize a short interpretive loop trail between the Lenox Parking Area and the edge of the Bonito Flow (0.1 miles).
- Construct a new Lenox Crater Loop (0.9 miles).
- The existing Lenox Crater Trail (0.3 miles) would be restored to natural conditions.
- Construct a new accessible trail from the Lava Flow Trail parking area (0.1 miles).
- Construct a new trail south of the Extended Learning Zone, to create a loop trail connecting to the Lenox Crater Trail (1.1 miles).
- The new trail system would be constructed using native materials with minimal ground disturbance techniques. Most segments of trail will be lined with rocks to identify the path. One short segment of trail would be built across the Bonito Lava Flow, and would require the use of rock breaking tools to create a flat tread surface. Trail sections have been identified that require the least modification to construct the trail. Retaining walls, braces, vegetation, or drainage systems may be constructed in areas susceptible to erosion caused by natural and human forces.
- The trail system would be primarily used by monument visitors during daylight hours. The trail and supported facilities would not be open at night.

*Related Facilities:*

- Up to two bathroom vault toilets will be installed within the new trail construction area. Some excavation will be needed to build the foundation; however, efforts would be made to find an area of previous disturbance for the facilities. No other utilities will be needed to operate the new trail system.
- Picnic sites and benches would be installed within the trail segments in the Extended Learning and Hiking Zones. Efforts would be made to find an area of previous disturbance for the picnic area and benches.
- The trailheads would be located at the Visitor Center, Bonito Campground, Lenox Crater, and the Lava Flow Trails.

- A new parking area would be constructed on the south side of the NPS access Road 545 northeast of Lenox Crater. The parking area would be approximately one acre or less in size and in an area of previous disturbance. This new parking area was one of the original entrance areas into the monument. A dirt road is still seen on the landscape running a north/south direction. Photographs show this area as previously used for parking. The new parking area will be hardened with asphalt, cement curbs, and striped with traffic instructions. All other parking facilities will remain in place and unchanged.
- Existing trees in the project area would be preserved to the extent possible; however, roughly 10 to 20 trees may be removed during construction of the new parking area. All areas disturbed by construction of the new trail system would be revegetated and recontoured to the style of the native landscape. Native vegetation, rocks, or other natural features would be used, as appropriate.

## Mitigation Measures

The following mitigation measures were developed to minimize the degree and/or severity of adverse effects and would be implemented during construction of both action alternatives, as needed:

- Visitors would receive prior orientation to the fragile nature of unique volcanic features and open cinder slopes.
- No trees over 14 inches diameter-at-breast-height will be removed.
- No aspen or Douglas fir trees will be removed.
- Plants and patches of Sunset Crater beards tongue and Sunset Crater ladies tresses will be surveyed in advance of trail construction, and avoided when trail routes are laid out.
- NPS-guides leading Discovery hikes will be trained in the identification of Sunset Crater beards tongue and Sunset Crater ladies tresses so they could be avoided.
- To minimize the amount of ground disturbance, staging and stockpiling areas would be in previously disturbed areas, away from visitor use areas to the extent possible. All staging and stockpiling areas would be returned to pre-construction condition following construction.
- Wherever possible, new facilities would be located to avoid impacts to important monument resources and values. In some areas, soils and vegetation area already impacted to a degree by various human and natural activities. Construction would take advantage of these previously disturbed areas wherever possible.
- Revegetation and recontouring of disturbed areas would take place following construction and would be designed to minimize the visual intrusion of the trail system. Revegetation efforts would strive to reconstruct the natural spacing, abundance, and diversity of native plant species using native species. All disturbed areas would be restored as nearly as possible to pre-construction conditions shortly after construction activities are completed. Weed control methods would be implemented to minimize the introduction of noxious weeds. Some trees may be removed, but other existing vegetation at the site would not be disturbed to the extent possible.
- If imported fill is needed to complete project objectives, the materials will be volcanic material of similar texture and color to match the construction site. In addition, all fill must not contain any invasive species.

- If fuels and hazardous materials are used, a spill-protection plan must be approved by the Park Safety Officer.
- Excavated soil may be used in the construction project; excess soil would be stored in approved areas and covered to prevent windblown dust.
- Topsoil would be removed and conserved separately then placed back on top after the work is completed. Materials would be stockpiled away from the edge of excavation and not placed within the drip line of remaining trees.
- Areas to be cleared would take precautions to protect the existing vegetation. Temporary barriers to protect existing trees, plants, and root zones would be provided. Excavation within drip lines of trees and shrubs would be hand cleared and excavated to minimize root damage. Fill material would be placed in depressions caused by clearing or grubbing unless further excavation or earthwork is indicated.
- If any previously unrecorded threatened, endangered, or special status species are discovered during construction, then all work would stop until qualified personnel evaluate the impact, and would allow modifications to any contracts or work plans for measures determined necessary to protect the threatened, endangered, or special status species.
- Site disturbance, including earthwork and clearing of vegetation, would be limited to a 100 feet wide corridor along the proposed trail alignment and a 50 feet wide perimeter around the proposed parking areas.
- Should construction unearth previously undiscovered cultural resources, work would be stopped in the area of any discovery and an NPS archeologist would consult with the Arizona State Historic Preservation Officer and the Advisory Council on Historic Preservation, as necessary, according to §36 CFR 800.13, Post Review Discoveries. In the unlikely event that human remains are discovered during construction, provisions outlined in the Native American Graves Protection and Repatriation Act (1990) would be followed.
- According to 2006 *Management Policies*, the National Park Service would strive to construct facilities with sustainable designs and systems to minimize potential environmental impacts. Development would not compete with or dominate monument's features, or interfere with natural processes, such as the seasonal migration of wildlife or hydrologic activity associated with wetlands. To the extent possible, the design and management of facilities would emphasize environmental sensitivity in construction, use of nontoxic materials, resource conservation, recycling, and integration of visitors with natural and cultural settings. The National Park Service also reduces energy costs, eliminates waste, and conserves energy resources by using energy-efficient and cost-effective technology. Energy efficiency is incorporated into the decision-making process during the design and acquisition of buildings, facilities, and transportation systems that emphasize the use of renewable energy sources.

## Alternatives Considered and Dismissed

The following alternatives were considered for project implementation, but were ultimately dismissed from further analysis. Reasons for their dismissal are provided in the following alternative descriptions.

- **Northern Trail Only** – This alternative was considered to determine if an out-and-back hike would have been a feasible approach to provide visitors more access to the monument. Although this alternative provided an extended experience for the visitor, it did

not meet our objectives to provide a fully integrated and interconnected experience nor did it provide a substantive increase in variety of experiences.

- **NPS Only Trail System** – This alternative considered the creation of trails only within the existing boundaries of the monument owned by the National Park Service. This alternative was dismissed because it did not meet the project objectives of creating an integrated and interconnected trail system. Under this alternative, the Bonito Campground and the monument's administrative area would continue to be disconnected for the monument and the monument would continue to be primarily a "drive-thru" experience.

## Alternative Summaries

Table 2 notes the changes in acreage for each management zone for the proposed alternatives. Table 3 summarizes the major components of Alternatives A, B, and C, and compares the ability of these alternatives to meet the project objectives (the objectives for this project are identified in the *Purpose and Need* chapter). As shown in Tables 3 and 4, Alternative C meets each of the objectives identified for this project, while Alternatives A and B do not address all of the objectives.

Table 2. Summary of acreage changes for the GMP (2002) Zones under each alternative.

Zone	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)
Resource Protection Zone	2847.2	2844.2	2755.4
Extended Learning Zone	188.7	188.7	158.4
Guided Adventure Zone	No change	No change	92.1
Hiking Zone	0.3	3.3	30.3
Motorized Sightseeing Zone	1.7	1.7	1.7
Total Acreage	3037.9	3037.9	3037.9

Table 3. Summary of Alternatives and How Each Alternative Meets Project Objectives.

Alternative Elements	Alternative A – No Action	Alternative B – GMP	Alternative C – SUCR Loop Trails
New Trail System	The existing trail system would continue to serve as the main visitor attractions.	A 0.9 mile trail would be built between the Bonito Campground and the Extended Learning Zone.	Approximately 8.1 miles of new trails would be added across NPS and U.S. Forest Service land. The existing Lenox Crater Trail would be obliterated and naturalized (0.3 miles).
Parking and Access	The existing parking and visitor access to the trails would not change.	The existing parking and visitor access to the trails would not change.	A new 1 acre or smaller parking area would be constructed east of Lenox Crater on the south side of Forest Road 545.
Utilities and Construction Staging	No new facilities, construction staging, or utilities would be needed.	No new facilities or utilities would be needed.	New facilities and minimal utilities would be needed to construct vault toilets, picnic areas, and benches.
Visitor Opportunities	Existing visitor facilities and trails would remain unchanged.	Visitors would enjoy a greater degree of freedom to explore the monument. A 0.9 mile trail would be built between the Bonito	Visitors would have multiple trail and hiking opportunities available throughout the year. Approximately 8 miles of trails would be open year round and a 92 acre Guided Adventure Zone

		Campground and the Extended Learning Zone.	would take visitors into areas with a unique volcanic landscape.
Project Objectives	Meets Project Objectives?	Meets Project Objectives?	Meets Project Objectives?
Establish an interconnected and fully integrated trail system	No. The current trail system is disjointed and is not interconnected between attractions.	Yes. The Lava Flow Trail, Lenox Crater Bonito Campground and the monument's administrative area would be connected with an out-and-back trail system.	Yes. The new trail system would fully integrate the administrative area and Bonito Campground with the main attractions at the monument, the Lava Flow Trail and Lenox Crater through a loop trail system.
Develop sustainable trail designs that are appropriate for the landscape	No. The current trail system would not be modified to reduce trail grades on slopes or realigned to appropriate grades. New trails would not be created and therefore, no new designs are necessary.	Yes. The new trail from the Bonito Campground to the Extended Learning Zone would be created with sustainability and resource protection in mind. However, the current Lenox Crater Trail would remain unchanged.	Yes. All new trails would be designed to reduce impacts to resources while reducing cyclic maintenance requirements. Current unsustainable trails would be obliterated and naturalized (Lenox Crater Trail).
Increase the recreational opportunities for monument visitors	No. The trails would remain in their current configuration.	Yes. Approximately 0.9 miles of trail would be added to the monument.	Yes. Visitors would have access to approximately 8 additional miles of trails within and surrounding the monument.
Eliminate unnecessary and duplicate trails	No. The trails would remain in their current configuration.	No. Existing trails would remain in their current configuration.	Yes. The Lenox Crater Trail would be obliterated and naturalized.

Table 4 summarizes the anticipated environmental impacts for Alternatives A, B, and C. Only those impact topics that have been carried forward for further analysis are included in this table. The *Environmental Consequences* chapter provides a more details explanation of these impacts.

Table 4. Environmental Impact Summary by Alternative.

Impact Topic	Alternative A – No Action	Alternative B – GMP Trail Implementation	Alternative C –Loop Trails and GMP Amendment
Geologic Resources and Soil	No disturbance of geologic resources and soil	Constructing the proposed Monument Trail would directly impact approximately 0.22 acres of level cinder terrain and 0.02 acres of the Bonito Flow. Where the trail traverses open cinder terrain, up to 30 feet on either side of the trail, or 3.3 acres, would be indirectly impacted by	The proposed new trail system would directly impact a total of 0.07 acres of the Bonito Flow and 0.83 acres of level cinder terrain. There would be no indirect impacts to the Bonito Flow, while an estimated 11.40 acres of level cinder terrain would be indirectly impacted. The proposed trails would not be routed near any unique or

		occasional off-trail visitor activity	fragile volcanic features, and there would be no direct or indirect impacts to them.
Vegetation	No disturbance of vegetation	The proposed Monument Trail and associated visitor activities would indirectly affect approximately 3.3 acres of vegetation habitat in volcanic cinder terrain.	Constructing the proposed Lenox Crater Loop Trail, accessible overlook trail and Sunset Crater View Trail would directly impact a total of 0.83 acres of sparse vegetation and plant habitat.
Wildlife	No disturbance of wildlife	Off-trail visitor activity, such as resting, viewing scenery, photography, picnicking, etc., might increase human presence disturbance to some wildlife species, but this would not be expected to measurably magnify disturbance over that already caused by moving motor vehicles and traffic noise within ¼ mile of the road.	Associated human presence and noise along the new trail system would measurably increase along the southwestern margin of the Bonito Lava Flow and southeast of Lenox Crater. Wildlife disturbance would mostly occur during the day, while many wildlife species are active at dusk, night, or dawn.
Special Status Species	No disturbance of special status species	Some plants of both species occur along the proposed trail alignment. The proposed Monument Trail would directly impact approximately 0.22 acres of habitat for both plant species. Some off-trail trampling by visitors might occur, but this would be expected to impact only one or a very few individual plants.	Overall, the proposed new trail system would directly impact approximately 1.05 acres of habitat for both special status plant species within the monument. Some off-trail trampling by visitors might occur, but this would be expected to impact only a very few individual plants.
Aesthetics	No disturbance of aesthetics	The creation of a new trail would negligibly modify the aesthetic qualities of the monument by slightly changing the landscape to accommodate visitors. However, the creation of the trail would create a long-term beneficial effect to the visual qualities of the monument.	The creation of a new trail system would modify the aesthetic qualities of the monument by changing the landscape to accommodate visitors. However, the creation of the trail would create a long-term beneficial effect to the visual qualities of the monument.
Visitor Use and Experience	No disturbance of visitor use and experience	Given the continued growth and use of trails in the monument and surrounding area, the incremental impact of construction the trail from Bonito Campground to the Lava Flow Trail under this alternative would have negligible to minor impacts on all monument visitors.	The construction of the proposed trails, benches, and picnic areas, the modification of management zones within the monument, and the establishment of Discovery Hikes in the Guided Adventure Zone would result in short-term, adverse impacts, and long-term, beneficial effects.

## Environmentally Preferred Alternative

According to the Council on Environmental Quality (CEQ) regulations implementing NEPA (43 CFR 46.30), the environmentally preferable alternative is the alternative “that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The environmentally preferable alternative is identified upon consideration and weighing by the Responsible Official of long-term environmental impacts against short-term impacts in evaluating what is the best protection of these resources. In some situations, such as when different alternatives impact different resources to different degrees, there may be more than one environmentally preferable alternative.”

Alternative A, no-action, is not the environmentally preferred alternative because it retains current trails that do not meet safety standards and beneficial range of uses within the monument. Because the current Lenox Crater Trail is constructed at an unsustainable grade to the top of the cinder cone, significant erosion and impacts occur that need to be mitigated on a regular basis. By not improving this design, the trail will not provide future generations a culturally pleasing and esthetic surrounding. In addition, the design of this trail does not preserve the natural aspects of the volcanic landscape.

Alternative B, found in the General Management Plan’s preferred alternative, is not the environmentally preferred alternative. Lenox Crater Trail would remain in its current alignment and remain at an unsustainable grade to the top of the cinder cone. Significant erosion and human impacts occur that need to be mitigated on a regular basis to mitigate effects of the trail. By not improving this design, the trail will not provide future generations a culturally pleasing and esthetic surrounding. In addition, the design of this trail does not preserve the natural aspects of the volcanic landscape.

Alternative C, the Loop Trails and GMP Amendment, is the environmentally preferred alternative. Although this option has a more intensive trail system, adding approximately eight miles of new trails, the management of this area is much more realistic and reasonable for monument staff. Confining visitor impacts to established trail corridors and management zones, impacts to resources are more isolated and designed to avoid very sensitive areas susceptible to visitor impacts. These trails, built with sustainable trail designs will survive for multiple generations while providing the widest range of beneficial uses and resource protection.

## Preferred Alternative

No new information came forward from public scoping or consultation with other agencies to necessitate the development of any new alternatives, other than those described and evaluated in this document. Because it meets the purpose and need for the project, the project objectives, and is the environmentally preferred alternative, Alternative C is recommended as the National Park Service preferred alternative. For the remainder of the document, Alternative C will be referred to as the preferred alternative.

## AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the affected environment (existing setting or baseline conditions) and analyzes the potential environmental consequences (impacts or effects) that would occur as a result of implementing the proposed project. Direct, indirect, and cumulative effects are analyzed for each resource topic carried forward. Potential impacts are described in terms of type, context, duration, and intensity. General definitions are defined as follows, while more specific impact thresholds are given for each resource at the beginning of each resource section.

- **Type** describes the classification of the impact as either beneficial or adverse, direct or indirect:
  - *Beneficial*: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
  - *Adverse*: A change that moves the resource away from a desired condition or detracts from its appearance or condition.
  - *Direct*: An effect that is caused by an action and occurs in the same time and place.
  - *Indirect*: An effect that is caused by an action but is later in time or farther removed in distance, but is still reasonably foreseeable.
- **Context** describes the area or location in which the impact will occur. Are the effects site-specific, local, regional, or even broader?
- **Duration** describes the length of time an effect will occur, either short-term or long-term:
  - *Short-term* impacts generally last only during construction, and the resources resume their pre-construction conditions following construction.
  - *Long-term* impacts last beyond the construction period, and the resources may not resume their pre-construction conditions for a longer period of time following construction.
- **Intensity** describes the degree, level, or strength of an impact. For this analysis, intensity has been categorized into negligible, minor, moderate, and major. Because definitions of intensity vary by resource topic, intensity definitions are provided separately for each impact topic analyzed in this EA.

### Cumulative Impact Scenario

The CEQ regulations which implement NEPA require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for both the no-action and preferred alternative.

Cumulative impacts were determined by combining the impacts of the preferred alternative with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects at the monument and, if applicable, the surrounding region. Because the scope of this project is relatively small, the

geographic and temporal scope of the cumulative analysis is similarly small. The geographic scope for this analysis includes actions within the monument's boundaries, while the temporal scope includes projects within a range of approximately ten years. Given this, the following projects were identified for the purpose of conducting the cumulative effects analysis:

- Flagstaff Area National Monuments Exotic Plant Management Plan – Ongoing. Treatment and monitoring of non-native plant species will continue within the monument.
- Flagstaff Area National Monuments Fire Management Plan – Ongoing.
- USFS Travel Management Rule – 2012. The USFS implemented their travel management rule that closed many of the roads surrounding the monument. These closures limit backcountry access for monument visitors on USFS lands.
- Forest Road 776 Closure – 2013. The USFS will close the access to Forest Road 776 from Forest Road 545 (the Loop Road). This will lengthen the travel for monument visitors wanting to access the Off-Highway Vehicle Area on USFS lands.
- Forest Road 545 Interagency Agreement – 2013. This interagency agreement defines the roles the NPS and USFS have along Forest Road 545.
- Four-Forest Restoration Initiative, Coconino and Kaibab National Forests – 2013. The United States Forest Service is proposing to conduct forest restoration activities within the Coconino and Kaibab National Forests over the next 10 years. Portions of the restoration work would extend near the boundaries of the monument. Impacts from this initiative would cause regional, short-term, adverse impacts for visitor use and experience. However, efforts of the restoration initiative would result in long-term, beneficial impacts for forest health surrounding the monument.

## Methodology

To quantify the effects of the proposed actions, the following assumptions are made throughout the impact analyses:

<b>Trails direct impacts:</b>	Acreage derived by calculating total length x 4 ft. wide trail in Hiking Zone. Acreage derived by calculating total length x 5 ft. wide trail in Ex. Learning Zone.
<b>Trails indirect impacts:</b>	Acreage derived by calculating total length x 30 ft. buffer off of centerline on both sides of trail (or 60 ft total width)
<b>Parking area indirect impacts:</b>	30 feet buffer around edges

## Geologic and Soils Resources

### Affected Environment

*Volcanic Features.* Sunset Crater Volcano National Monument is a classic cinder cone volcano, and is the youngest of more than 550 known basaltic vents in the San Francisco Volcanic Field in north-central Arizona (Holm 1987, Holm & Moore 1987). The monument is dominated by a relatively barren landscape, comprised almost exclusively of dark volcanic basalt rock. The largest volcanic features within the monument are: (1) the Sunset Crater Volcano, at the southeastern corner; (2) the associated Bonito Lava Flow, in the center and northwestern corner; (3) Lenox Crater, an older and smaller volcano at the southwestern corner; and, (4) the remnants of even older volcanic craters and hills around the northeastern corner. Another 30, or more, older cinder cones, cinder crescents, cinder mounds, and exposed lava flows occur within five miles of the monument. O'Leary Mountain and Darton Dome are the oldest and most massive volcanic features, forming the highest terrain to the northwest. All formed in a series of distinct eruptions over time, were

then eroded by wind and water, and subsequently partially or completely buried beneath later eruptions.

Recent studies have determined the eruption that formed the Sunset Crater Volcano most likely occurred during the 1180's A.D., and lasted less than five years (Elson et al. 2005, Elson et al. 2007, Elson et al. 2011). The molten basaltic lava that extruded during the Sunset Eruption most likely rose to the surface through a deep, southeast-to-northwest trending, linear fault in the earth's crust. An erupting volcanic fissure formed along a six mile section of this fault, with the Sunset Crater Volcano building at the northwest end. During the peak of the fissure eruption, at least nine other cinder cones, numerous smaller spatter cones and fountains, fumaroles, and three lava flows were simultaneously active, forming a "ring-of-fire" style eruption much like those observed today in Hawaii. Most of the other fissure eruption features are on the adjacent Coconino National Forest.

The Sunset cinder cone began building during the latter stage of the fissure eruption, as decompressing molten lava was ejected high into the air while still in a hot, liquid state. While airborne, the lava cooled, crystallized, and fell as ash, cinder, and popcorn-sized particles called "scoria". Larger material up to three feet in diameter, called "bombs", was also ejected. The larger, heavier material accumulated closest around the vent to build a cone-shaped volcano with a crater depression centered over the vent.

As the Sunset cinder cone was building, two basalt lava flows originated from the base of the cone. The Kana-A Flow, an a' a type lava flow, extruded near the eastern base of Sunset Crater. The Kana-A lava flowed more than six miles to the northeast, filling a narrow valley on lands now within the Coconino National Forest. The Bonito Flow, a composite pahoehoe and a' a lava flow, extruded from the northwest base of Sunset Crater. The Bonito lava flowed into a small basin surrounded by the Sunset cinder cone and five older volcanic domes and cones, and locally pooled to cover about two-square-miles. The Bonito lava pulsed to the surface in three stages, reaching a total thickness of up to 100 feet. As the Bonito lava began flowing away from the base of Sunset Crater, portions of the cinder cone were torn away and carried on top of the flowing lava as far as a mile to the northwest (Holm 1987). The churned apart remnants of the older cone remain visible on top of the flow as a series of low hills, termed "agglutinate mounds".

While the Kana-A and Bonito flows were still extruding, the Sunset cinder cone continued erupting, eventually rebuilding the symmetrical cinder cone we see today. The simultaneous eruption of Sunset Crater Volcano and both lava flows is evident as the tops of both flows are covered by up to three feet of cinder and ash. In contrast, the last stage of the Bonito Flow occurred after the Sunset cinder cone was going extinct, evident by its jagged a' a lava surface and lack of any cinder cover. A number of other small-scale eruptive features formed as part of the Bonito Lava Flow, including: spatter cones (or "hornitos"), spatter mounds and ramparts, lava "breakouts", lava "squeeze-ups", lava tubes or caves, xenoliths, lateral extension fissures, and surface collapse areas.

While the Sunset Crater Volcano was erupting, loose ash and cinders were ejected over one and a half miles above the crater vent, drifting on prevailing winds and covering more than 800 square miles around the cinder cone (Amos 1986, Hooten et al. 2001, Hooten and Ort 2007). The Sunset cinder cone eventually built to 1,000 feet high and more than a mile wide across its base, with a central crater vent that is about 400 feet deep and 2,250 feet across. As the Sunset volcano went extinct, gaseous steam vents formed around the crater rim. These last stage fumaroles left distinct white, yellow, and pink colored deposits, comprised of a variety of gypsum, calcite, sulfur, and iron-oxide minerals (Hanson et al. 2000).

Except for the last stage fumarole vents, most of the eruption features described thus far are comprised exclusively of cooled basaltic lava - it is only the manner in which the lava extruded and cooled into solid rock that gives the landscape its unique and characteristic forms. Many of the smaller and more intriguing volcanic features are relatively rare. Some are very porous and brittle, or the lava spatter that formed them is only partially welded, leaving them fragile and vulnerable to trampling and/or being picked apart over time in areas receiving heavy visitor activity. The best examples are the hornito and adjacent spatter mounds located along the Lava Flow Trail. Repeat photographs show that much of the top and sides of these have been worn away since the 1950's. In an effort to better document the volcanic features within the monument, the NPS and academic geologists undertook a thorough field survey and mapping effort during 2007 and 2008. The results from the survey were used to develop a framework for classifying the most unique and vulnerable features, and to establish a baseline monitoring their conditions over time. Table 5 summarizes the results. With this information, the NPS may take appropriate management action to deter further damage to unique volcanic features.

Table 5. Summary table of volcanic features identified during the 2007-2008 survey of Sunset Crater Volcano National Monument.

Volcanic Feature Type	Total number in monument	Rare and/or Fragile?	Example within current visitor access area?
Hornito	4	Y	Y
Spatter mound/rampart	9	Y	Y
Lava breakout	76+	N	N
Lava squeeze-up	3.5 linear miles (est.)	N	Y
Xenolith	1000's (est.)	N	Y
Lava tubes or caves	1	Y	Y
Lava lateral extension fissure	1 (0.25 miles long)	N	N
Lava collapse zone	2	N	N
Agglutinate mound	13	Y	N
Fumarole mineral deposits	21 (1.3 total acres est.)	Y	N

*Volcanic Cinder Soils.* Sunset Crater is considered unique by soil scientists because it is very recent and unweathered volcanic terrain that is in the earliest stages of soil formation. Over the nine centuries that have passed since the eruption, weathering processes have begun to act upon the basalt to physically and chemically break it down into finer particles and clay minerals. Dust transported long distances by the wind over the centuries is settling and mixing with the basalt-derived clays. The clay and wind-blown dust particles accumulate within the upper layer of loose volcanic scoria deposits. As this occurs, a large volume of loose cinder continues to be washed by storm downbursts and windblown across the surface of the cinder terrain, leaving the viable clay and silt soil horizon in a layer about one foot below the surface. This "nascent" or "incipient" soil horizon is typically orange to gray in color and ranges from a few inches to a few feet thick. Locally, soil formation is occurring more rapidly on the north-facing slopes of Sunset Crater, Lenox Crater, and other nearby cinder hills, which are more shaded, where snowpack and ground moisture persists longer, and which are sheltered from prevailing southwestern winds. Based upon research on nearby older cinder cones, approximately 35,000 years is required for the natural processes of weathering, accumulation, and nutrient mineralization to form soils capable of supporting the mature ponderosa pine forest vegetation typical of the surrounding area (Selmants and Hart 2008). Under the prevailing high-altitude, cold, arid climate, the soil formation process is also considerably slower than warmer and wetter volcanic areas at sea level or closer to the tropics.

The deep cinder deposits which form much of the barren terrain within the monument can be disturbed by heavy trampling over long periods of time. The only related study to date focused on off-road vehicle impacts on adjacent cinder terrain on the Coconino National Forest (Kennedy 2005). The study documented that intense disturbance disrupts cinder soil function and inhibits vegetation establishment. Although visitor use may not be as intense as off-road vehicle travel, sustained activity by the large number of visitors to the monument can approximate localized but similar effects to those documented in the study. This is most evident on the abandoned trail to the top of the Sunset Crater Volcano. The trail was closed in 1973 because it had eroded into a rut that was six feet deep, exposing ponderosa pine tree roots and causing vegetation to die back. Although the trail was closed and rehabilitated 40 years ago, the original route is still partially visible as a large, faint stripe zigzagging up the western slope of the cinder cone.

In 1998, the NPS closed the remainder of the backcountry because unacceptable impacts were occurring in the fragile terrain and eruption features to the north of the Lava Flow Trail. The 2002 GMP formalized this closure by placing the area within the Resource Preservation Zone, where access is restricted to NPS management, scientific research, and other limited activities under special permits. Within the closure area, segments of unplanned "social" trail segments are still visible on steep cinder slopes 15 years after the closure, while no evidence of visitor use is visible on level cinder terrain and slopes that are less than 15 degrees. Presumably, visitor footprint patterns on the level to gentle terrain have naturally weathered out over this time by rainstorm sheetflow and wind blowing them smooth. The NPS is currently implementing a project to survey and map all evidence of past and current recreational activity within the monument, including tracks from a number of illegal off-road driving incidents that have occurred over the last 10 to 20 years. This effort is intended to provide a baseline for assessing the relative vulnerability of the cinder terrain to various activities, and for monitoring changes over time. Observations by resource specialists, together with preliminary results from the ongoing survey, suggest that areas of level to gently-rolling terrain are more resilient than steep cinder slopes.

## Intensity Level Definitions

The recent volcanic terrain and Sunset Eruption features are the primary resources for which Sunset Crater Volcano National Monument was established to protect. Impact topics for geologic and soils resources that were identified through the public and internal NPS scoping processes include: (1) preserving unique and rare volcanic features, such as hornitos, spatter mounds and ramparts, agglutinate mounds, lava tubes or caves, and fumarole deposits; (2) managing visitor use impacts to large scale and more abundant volcanic features, such as cinder cone volcanoes and lava flows; and, (3) minimizing disruption to soil formation processes in the geologically young volcanic cinder terrain. Intensity of impacts are defined as follows:

- Negligible:** An action that would persist only for a short period of time (from hours to months), or that would cause no observable long-term change to the current condition of volcanic features and/or cinder terrain within the monument.
- Minor:** An action that would locally affect only widespread or abundant volcanic features and/or a small proportion of cinder terrain within the monument. The change would be perceptible, but would require considerable effort to document or measure.
- Moderate:** An action that would affect: (1) a portion of one or more unique volcanic features, but other examples in near pristine condition would not be impacted; (2) a large proportion of a large-scale or abundant volcanic feature; or, (3) no more than ten percent of the total area of cinder terrain within the monument. The alteration

would be readily measureable using established monitoring methods. The volcanic resource or cinder terrain may be permanently altered from current conditions, but limited to a finite number of volcanic features or area of cinder terrain.

**Major:** An action that would permanently affect: (1) all of one or more rare and irreplaceable volcanic features, (2) most or all of a large-scale or abundant volcanic feature; or, (3) more than ten percent of the total area of cinder terrain within the monument. The change would result in permanent change to the integrity of an entire class of rare and unique features, and/or affect the soil formation process over a large area of cinder terrain.

### **Impacts of Alternative A (No Action Alternative)**

Under the No-Action Alternative, access roads, parking, trails, and visitor-support facilities within the monument would continue to occupy and directly impact approximately 130 acres, or less than 5% of the total volcanic landscape within the monument. Visitor activities and associated impacts would remain concentrated around the Lava Flow Trail and the Lenox Crater Trail areas. In its current alignment, the trail leading up Lenox Crater would remain eroded into the cinder substrate. The NPS could occasionally rehabilitate and attempt to manage stormwater runoff on the Lenox Crater Trail, but it would likely eventually erode again. Over the long term, most direct impacts to the steep cinder slopes of the Lenox cinder cone volcano would remain localized within or immediately adjacent to the current trail alignment. Once visitors reach the crest of the current Lenox Crater Trail, off-trail activity also occurs over a sizeable area around the crater rim and inner crater slope, indirectly impacting an estimated 11.1 acres.

Cumulative Effects: Direct and indirect impacts to volcanic features and cinder terrain from proposed new trails under the other alternatives would not occur. Most unique and fragile volcanic features would remain within the Resource Preservation Zone, where they are protected from visitor use impacts, a long term, minor beneficial impact compared to Alternative C.

Conclusion: Approximately 95% of the monument area would remain within the Resource Preservation Zone, closed to general public access in order to protect the geologic resources. Impacts within this zone would remain limited to NPS administrative and management actions, such as wildfire suppression, resource inventory and monitoring, and resource protection patrols. Other access would remain restricted, including other authorized scientific, educational, and special uses under NPS permits.

### **Impacts of Alternative B (GMP Trail Implementation)**

Under Alternative B, all of the existing access road, parking areas, trails, and visitor-support facilities within the monument boundary would continue to be used, and impacts would be the same as the No Action Alternative. Most visitor use impacts to volcanic features and cinder terrain would remain concentrated around the Lava Flow Trail and Lenox Crater Trail areas, the same as the No Action Alternative. The cinder soil erosion caused by the Lenox Crater Trail in its current alignment would persist, but over the long term would remain localized within or immediately adjacent to the current trail alignment, considered to be a long-term negligible to minor adverse impact. Off trail activity along the rim and slopes of the Lenox Crater cinder cone would continue to indirectly impact an estimated 11.1 acres.

Cumulative Effects: Constructing the proposed Monument Trail would directly impact approximately 0.22 acres of level cinder terrain and 0.02 acres of the Bonito Flow. Where the trail traverses open cinder terrain, up to 30 feet on either side of the trail, or 3.3 acres, would be

indirectly impacted by occasional off-trail visitor activity, such as resting, viewing scenery, photography, picnicking, etc. The trail route entirely avoids all known unique and fragile volcanic features, and would not be routed on steep cinder slopes. The proposed Monument Trail and associated visitor activities would affect a minute fraction of the total area of cinder terrain and Bonito Lava Flow within the monument, considered to be a long-term, minor adverse impact.

Most unique and fragile volcanic features would remain within the Resource Preservation Zone, where they are protected from visitor use impacts, a long term, minor beneficial impact compared to Alternative C.

Conclusion: Under Alternative B, the total area impacted by access roads, parking, trails, and visitor-support facilities within the monument would increase to by less than 5 acres over existing conditions to a total of 135 acres. This would still be less than 5% of the total volcanic landscape within the monument, the same as the No Action Alternative, and considered to be a long-term, negligible adverse impact. The remaining 95% of the monument would remain within the Resource Preservation Zone, where impacts would remain the same as the No Action Alternative.

### **Impacts of Alternative C (Preferred Alternative)**

The proposed Monument Trail connecting the Visitor Center and Bonito Campground to the Lava Flow Trail would have a long-term, minor adverse impact, as described under Alternative B.

Formalizing a short Bonito Interpretive Loop Trail between the Lenox Parking Area and the edge of the Bonito Flow would directly impact 0.05 acres of the Bonito Flow where the trail tread surface is built. There would be no indirect impacts adjacent to the Bonito Flow because it is comprised of extremely rugged and loose solid basalt rock, and would mostly be avoided by visitors. Approximately 0.15 acres of cinder terrain adjacent to the existing Lenox parking area are currently being impacted from ongoing unmanaged visitor access. This impact would be reduced by constructing a well-designed trail that guides visitors along the edge of the Bonito Flow. Compared to existing conditions, this would be a long-term, negligible to minor beneficial impact.

Constructing the proposed Lenox Crater Loop Trail would directly impact 0.60 acres and indirectly impact 4.32 acres of the Lenox Crater cinder cone, in addition to the 11.1 acres currently impacted along the upper rim and slopes. The trail would be aligned at a gentler angle to minimize impacts to the steep cinder slopes of Lenox Crater. The proposed trail would formalize a route for visitors to hike along approximately 0.4 miles of the crater rim. The current Lenox Crater Trail would be abandoned and restored to natural conditions, eliminating direct impacts to approximately 0.18 acres and indirect impacts to an estimated 2.18 acres of steeply sloping cinder terrain. The net increase in total area occupied by trail and indirectly impacted by trailside visitor activities along the proposed Lenox Crater Loop Trail would cause long term, minor adverse impacts to the Lenox cinder cone volcano.

A short, accessible overlook trail would be constructed from the southwestern end of the Lava Flow parking area, which would directly impact 0.08 acres of level cinder terrain. Off-trail activity on either side of this trail would indirectly impact an additional estimated 0.10 acres of cinder terrain.

The proposed Sunset Crater View Trail would be constructed south of the Extended Learning Zone, following the southeastern margin of the Bonito Flow, to create a loop trail connecting from the Lava Flow Trail to the Lenox Crater Loop Trail. This section of new trail would directly impact 0.53 acres of level cinder terrain. Occasional off-trail visitor activity, such as resting, photography,

picnicking, etc., would indirectly impact up to 30 feet on either side of the trail, or 8.00 acres of cinder terrain.

Cumulative Effects: Taken as a whole, the proposed new trail system would directly impact a total of 0.07 acres of the Bonito Flow and 0.83 acres of level cinder terrain. There would be no indirect impacts to the Bonito Flow, while an estimated 11.40 acres of level cinder terrain would be indirectly impacted. After the current Lenox Crater Trail is restored to natural conditions, a net total of 0.42 acres of the Lenox Crater cinder cone would be directly impacted by trail surface, while 13.24 acres of the crater rim and slopes would be indirectly impacted by associated off-trail activity. The proposed trails would not be routed near any unique or fragile volcanic features, and there would be no direct or indirect impacts to them. Overall, a small proportion of the Bonito Lava Flow, level cinder terrain, and the Lenox Crater cinder cone would be altered by the proposed new trail system, resulting in long-term, minor adverse impacts.

Under Alternative C, a new parking area, restroom, and picnic area would be constructed on the south side of the NPS access road, near the northeast base of Lenox Crater. Picnic tables and up to two vault toilets would be installed around the parking area. These facilities would directly impact up to 1.0 acre. Approximately 0.35 acre of the site has been previously disturbed as the original entrance road to the monument. The road was abandoned around 1965. The area was never actively restored to natural conditions, and the original roadbed of imported, coarse volcanic cinders is still evident. Much of this area already receives heavy off-trail visitor activity near the existing Lenox Trailhead, and an additional estimated 0.20 acres around the southern edge of these facilities would indirectly be impacted by off-trail activity. The construction and use of the proposed parking and visitor facilities would affect a small portion of the level cinder terrain within the monument, much of it already disturbed. This action would have a long-term, minor adverse impact.

Under Alternative C, a program of NPS-guided discovery hikes would be implemented within the proposed Guided Adventure Zone. No trails would be constructed within this area. The new zone encompasses approximately 34.7 acres that were formerly within the Extended Learning Zone, and 57.4 acres that were formerly within the Resource Preservation Zone. Several known unique and fragile volcanic features occur within the proposed Resource Preservation Zone, including seven agglutinate mounds, two small spatter mounds, and two small hornitos. Certain features that are both durable and abundant, but not prevalent within the current visitor use areas, such as the largest lava “squeeze-up”, a lava extension fissure, and three largest spatter ramparts directly over the Sunset Eruption fissure vent, may readily be viewed and interpreted during the hikes. The total area within the proposed Guided Adventure Zone is 92.1 acres, but under the proposed mitigation, hiking would be prohibited on cinder slopes greater than 15% slope angle. An analysis of the topography within the zone yields a total area of 72.7 acres of level terrain, where guided hiking would be allowed. Other mitigation is proposed to prevent impacts to all of the unique volcanic features within the zone, including: (1) Restricting group size to ensure effective interaction between the NPS guide and visitors; (2) Restricting the total number of visitor use days per calendar year; (3) Ensuring visitors receive orientation to sensitive park resource prior to the hike; and, (4) providing for future management decisions to rest the area if the level of impacts to the volcanic resources exceeds planning thresholds. With full implementation of the proposed mitigation, NPS-guided discovery hikes within the Guided Adventure Zone would impact up to 72.7 acres of level cinder terrain. This action would have long-term, negligible adverse impacts to unique volcanic features and long-term, minor adverse impacts to level cinder terrain within the monument.

**Conclusion:** Under Alternative C, the total area within the monument that is impacted by access roads, parking, trails, visitor-support facilities, and visitor activities would increase from 130 acres under existing conditions to a total of 228 acres. This would be 7.5% of the total volcanic landscape within the monument, an overall increase of 2.5% compared to both the No Action Alternative and Alternative B. The overall impacts to volcanic landscape within the monument would be long-term, minor and adverse. The remaining 93.5% of the monument area would remain within the Resource Preservation Zone, where impacts would remain the same as the No Action Alternative.

## Vegetation

### Affected Environment

The vegetation growing within the monument is considered unique by ecologists because it is in the pioneering stages of recovery on the recent volcanic terrain. While patches of coniferous trees are readily visible from almost anywhere within the monument, the lack of ground-covering plants (such as grasses) and diverse forb and shrub communities is evident. In many places, "islands" of ponderosa pine with understory vegetation and pine needle-cast essentially float where patches of thin soils are developing within the deep volcanic cinder deposits. Vegetation and organic surface litter patches are well-developed over the north and east-facing slopes of the Sunset cinder cone, Lenox cinder cone (which is older with better developed soil), and in swales and gently rolling cinder terrain to the east of the Bonito Flow and north of Sunset Crater Volcano.

The vegetation within the monument has been thoroughly inventoried and mapped (Hansen et al. 2004). Twenty-one map cover classes are recognized, plus un-vegetated lava flow surface. With the exception of prolific lichen growth, approximately 50% percent of the area within the monument remains mostly barren, with another 10% remaining very sparsely vegetated. Most of the vegetation is comprised of pure ponderosa pine stands, but pockets of Douglas fir trees occur on heavily shaded slopes. Pinyon pine and Utah juniper are also common associates along the eastern and northern boundary. Tree canopy cover within the ponderosa patches rarely exceeds 75%, and the stands are classified as woodland. A few small aspen groves grow on the north slopes of the cinder cones and around the perimeter of the Bonito Flow. The tree stands typically have an open understory of barren volcanic cinder and needlecast, with patches of shrubs, including: apache plume, rabbitbrush, four-wing saltbush, desert olive, three-leaf sumac, ocean spray, mountain tail-leaf, California brickellbush, Torrey's joint-fir, wax currant, and tarragon. Common grasses include: blue grama grass, mountain muhly grass, sand bluestem grass, squirreltail grass, and Arizona fescue grass. Common forbs and wildflowers include: meadow rue, crisperleaf buckwheat, purple cluster geranium, sagewort, crenulate ladies tresses, purple locoweed, prairie flax, beardlip Penstemon, mountain monardella mint, and Newberry's twinpod. Given the small area within the monument, it is relatively rich in plant species, with 166 documented species.

Vegetation is slowly establishing on the "nascent" or "incipient" soils forming in the upper layer of the volcanic cinder terrain (described in the Geology/Soils section, above). The deep cinder deposits are loose, highly porous, and mostly sterile, and it is difficult for plants to germinate, establish root systems, and extract water and nutrients within them. Left unperturbed, the terrain would eventually recover to mature ponderosa pine forest and montane meadow vegetation evident on the older volcanic terrain to the west of the monument. Before the monument was established, most of the ponderosa stands were cut for timber during the 1910's. The tree stands are mostly second growth, with excessive numbers of young, small diameter trees that would have naturally been thinned by regularly recurring wildfires, which have mostly been suppressed by Federal agencies over the last 140 years. Under NPS management, concentrated activity by large numbers

of visitors on the fragile volcanic cinder terrain has locally disrupted the slow process of soil formation, which in turn retards plant establishment. Landforms with steep cinder slopes are more vulnerable to heavy trampling impacts, particularly south- and west-facing slopes, which are subject to hotter surface temperatures and fierce southwestern winds.

### Intensity Level Definitions

Impact topics for vegetation that were identified through the public and internal NPS scoping processes include: (1) the direct removal or loss of plants or vegetation patches for the construction of trails and other facilities; (2) the disruption of soil formation and ability to support plants and vegetation by intensive visitor activity on the harsh volcanic cinder terrain; (3) minimizing impacts to large, old (140 years or older) conifer trees; and (4) minimizing impacts to aspen groves and Douglas fir stands, which are relatively rare within the monument. Intensity of effects are articulated in the effects analysis as follows:

- Negligible:** An action that would affect only a few individuals of an abundant plant population within Sunset Crater Volcano National Monument.
- Minor:** An action that would affect a relatively small number of plants of an abundant plant population or affect a relatively small area of a given vegetation type within Sunset Crater Volcano National Monument. The change would either be very localized in area or the total number of plants affected would be so small that it would have no perceptible consequence to the entire population or vegetation type within the monument.
- Moderate:** An action that would affect: (1) a relatively large proportion of individuals or relatively large area inhabited by a plant population; (2) a relatively large number of individuals within multiple plant populations; (3) the existing dynamics between different plant species that occur in association with each other; or, (4) a relatively large area of a given vegetation type within Sunset Crater Volcano National Monument. A plant population or vegetation type might be permanently altered, but all affected plant species and vegetation types would remain indefinitely viable within the monument.
- Major:** An action that would affect most or all of an entire plant species population, plant association dynamics, or given vegetation type within Sunset Crater Volcano National Monument.

### Impacts of Alternative A (No Action Alternative)

Cumulative Effects: Under the No-Action Alternative, access roads, parking, trails, and visitor-support facilities within the monument would continue to occupy and directly impact approximately 130 acres, or less than 5% of the total available plant habitat within the monument. Visitor activities and associated impacts to tree root systems, patches of plant leaf litter, and understory plant communities would remain concentrated around the Lava Flow Trail and the Lenox Crater Trail areas. A small number of aspen trees also occur near these areas, most of which receive some off-trail trampling around their root zones. In its current alignment, the trail leading up Lenox Crater would remain eroded with fully exposed tree roots, which would continue to stress the affected trees, possibly leading to mortality in some of them. Off-trail activity along the rim and slopes of the Lenox Crater cinder cone would continue to indirectly impact forest and understory vegetation within an estimated 11.1 acres.

Conclusion: Approximately 95% of the monument area would remain within the Resource Preservation Zone, closed to general public access in order to protect unique and fragile volcanic resources. Impacts to plants and vegetation within this zone would remain limited to NPS administrative and management actions, such as wildfire suppression under the Fire Management Plan (NPS 2008), resource inventory and monitoring, and resource protection patrols. Other access would remain restricted to Native American traditional activities, or other authorized scientific, educational, and special uses under NPS permits. Most aspen groves and all Douglas fir stands are within this zone, where they would remain protected from disturbance. Overall, Alternative A would create local, long-term, minor, adverse effects.

### **Impacts of Alternative B (GMP Trail Implementation)**

Under Alternative B, all of the current access road, parking areas, trails, and visitor-support facilities within the monument boundary would continue to be used, and impacts would be the same as the same as the No Action Alternative. Most visitor activities and associated impacts to tree root systems, patches of plant leaf litter, understory plant communities, and aspen groves would remain concentrated around the Lava Flow Trail and the Lenox Crater Trail areas, the same as the No Action Alternative.

Cumulative Effects: The proposed Monument Trail alignment traverses an area that is mostly barren cinder terrain and barren lava flow surface. Where vegetation does occur, the ponderosa pines are open enough that the trail route can be laid out to avoid them, so there would be no direct impacts. The trail alignment would also follow close to aspen groves that grow along the southwestern perimeter of the Bonito Flow, but no aspens would need to be removed to construct the trail. Vegetation and plant litter on either side of the trail would be lightly disturbed by occasional off-trail visitor activity, such as resting, viewing scenery, photography, picnicking, etc. The intensity of visitor activity is not anticipated to result in undue stress or mortality in tree species, but limited mortality in understory shrubs and forbs may occur in very small areas. The proposed Monument Trail and associated visitor activities would indirectly affect approximately 3.3 acres of vegetation habitat in volcanic cinder terrain. No large, old conifer trees would be removed, and the remaining aspen groves and all Douglas fir stands would remain protected within the Resource Preservation Zone. This action would affect a small number of plants and minute area of total available plant habitat within the monument, and is considered to be a long-term, minor adverse impact.

Conclusion: Under Alternative B, the total area impacted by access roads, parking, trails, and visitor-support facilities within the monument would increase by less than 5 acres over existing conditions to a total of 135 acres. This would still be less than 5% of the total volcanic landscape within the monument, the same as the No Action Alternative, and considered to be a long-term, negligible adverse impact. The remaining 95% of the monument would remain within the Resource Preservation Zone, where impacts would remain the same as the No Action Alternative.

### **Impacts of Alternative C (Preferred Alternative)**

Under Alternative C, all existing road access and visitor support facilities would continue to be used. Visitor activities would primarily remain concentrated around the Lava Flow Trail and the Lenox Crater Trail areas, where associated impacts to tree root systems, patches of plant leaf litter, understory plant communities, and aspen groves, would be the same as the No Action Alternative.

Cumulative Effects: The proposed Monument Trail connecting the Visitor Center and Bonito Campground to the Lava Flow Trail would have a long-term, minor adverse impact, as discussed under Alternative B.

A small aspen grove adjacent to the existing Lenox parking area is currently being impacted from ongoing unmanaged visitor access. This impact would be reduced by constructing a well-designed trail that guides visitors along the edge of the Bonito Flow. Compared to existing conditions, this would be a long-term, negligible to minor beneficial impact.

Constructing the proposed Lenox Crater Loop Trail, accessible overlook trail and Sunset View Trail would directly impact a total of 0.83 acres of sparse vegetation and plant habitat. The affected trail alignments are mostly within barren cinder terrain, with some areas having open ponderosa pine trees and sparse understory shrub or grass vegetation. Some small-diameter ponderosa pine trees might be removed within the trail alignments, but the tree stands are sufficiently open that most of the trails could be routed between trees. When constructed, an estimated total of 11.40 acres of vegetation and plant habitat adjacent to the proposed Lenox Crater Loop, accessible overlook, and Sunset View trails would be indirectly impacted by off-trail visitor activities, such as resting, viewing scenery, photography, picnicking, etc. After the proposed Lenox Crater Loop is implemented, the current Lenox Crater Trail would be restored to natural conditions. This would result in a net total of 13.24 acres where associated off-trail activities would indirectly impact open ponderosa pine vegetation around the upper crater rim and slopes. Short segments of proposed trails across the Bonito Flow would have no direct or indirect impacts because this habitat is barren of vegetation. The proposed trails would not be routed through aspen groves or Douglas fir stands, and there would be no impacts to these tree populations. Implementing the new trail system would directly impact only a small number of plants and only for species with abundant plant populations. A small area of widespread vegetation types within the monument would be directly and indirectly impacted. The proposed new trail system would result in long-term, minor adverse impacts to plant populations and vegetation within the monument.

Under Alternative C, a new parking area, restroom, and picnic area would be constructed on the south side of the NPS access road, near the northeast base of Lenox Crater. As many as 20 ponderosa pines would be removed for the parking area, and the proposed facilities would directly impact up to 1.0 acre of ponderosa pine/sparse shrub understory vegetation. An additional estimated 0.20 acres of open ponderosa pines around the southern edge of these facilities would indirectly be impacted by off-trail activity. Approximately 0.35 acre of the site has been previously disturbed as the original entrance road to the monument, and much of this area already receives heavy off-trail visitor activity near the existing Lenox Trailhead. The construction and use of the proposed parking and visitor facilities would affect a small area of within the monument, much of it already disturbed. This action would have a long-term, minor adverse impact.

Under Alternative C, a program of NPS-guided discovery hikes would be implemented within the proposed Guided Adventure Zone. No trails would be constructed within this area. The total area within the proposed zone is 92.1 acres, but guided hikes would be restricted to 72.7 acres of level terrain. The vegetation within this area ranges from barren cinder terrain to mature ponderosa pine woodland with sparse shrub and herbaceous understory. Under the proposed mitigation for this action, both group size and the number of guided hikes per calendar year would be limited. The area could also be rested for periods of time if unacceptable impacts should occur. The indirect impacts from NPS-guided, off-trail hiking within the Guided Adventure Zone would be of much less intensity than current impacts at the heavily visited Lava Flow and Lenox Trail areas. This

action would have long-term, negligible to minor adverse impacts to vegetation and plant habitat within the monument.

**Conclusion:** Under Alternative C, the total area of plant habitat within the monument that is impacted by access roads, parking, trails, visitor-support facilities, and visitor activities would increase from 130 acres under existing conditions to a total of 228 acres, an overall increase from 5% to 7.5% compared to the No Action Alternative. The overall short-term impacts to vegetation within the monument would be negligible because only a few individual trees and localized patches of understory vegetation would be impacted by the trails, associated visitor facilities, and adjacent off-trail visitor activity. The total impact under this alternative would be long-term, adverse and minor, because existing habitat for plants and vegetation would be reduced by a small amount, and because most affected vegetation would be anticipated to eventually regrow should the trails or facilities ever be abandoned and removed. The remaining 93.5% of the monument area would remain within the Resource Preservation Zone, where impacts would remain the same as the No Action Alternative.

## Wildlife

### Affected Environment

The impacts of the key actions for all three alternatives on widespread and abundant wildlife species are considered here, while impacts to protected and rare species are considered in the Special Status Species section, below. Past efforts to survey and study the wildlife within Sunset Crater Volcano National Monument are extremely limited, and the NPS has very little scientific information on the distribution and habitat use by wildlife species. The Bonito Lava Flow, which dominates more than 25% of the surface area within monument, is extremely inhospitable to foot travel, and probably does not provide habitat for larger animals. The sparse vegetation within the remainder of the monument probably provides little forage and cover, and wildlife within the monument is largely adapted to open terrain, rocky outcrops and bluffs, and conifer tree canopy habitats.

Preliminary species lists, based upon reliable records have been compiled, with 39 mammal, 125 bird, and 11 reptile species known to occur (NPS 2013). Common mammals include: deer mouse, pinyon mouse, pocket gopher, packrat, antelope squirrel, rock squirrel, Abert's squirrel, ringtail, porcupine, coyote, mule deer, and mountain lion. Common bird species include: Broad-tailed Hummingbird, Rufous Hummingbird, Dark-eyed Junco, Violet-green Swallow, White-throated Swift, Mourning Dove, Western Meadowlark, Townsend's Solitaire, Mountain Bluebird, Western Bluebird, Mountain Chickadee, White-breasted Nuthatch, Pygmy Nuthatch, Yellow-rumped Warbler, American Robin, Northern Flicker, Pinyon Jay, Steller's Jay, Common Nighthawk, Raven, American Kestrel, and Red-tailed Hawk. Common reptiles include Eastern Fence Lizard and Tree Lizard.

### Intensity Level Definitions

Impact topics for wildlife that were identified through the public and internal NPS scoping processes include: (1) the direct removal or loss of wildlife habitat for the construction of trails and other facilities; and, (2) increased human presence and noise disturbance to wildlife within the monument; and (3) increased road-related wildlife habitat fragmentation and/or vehicle-caused wildlife mortality. Intensity of effects are articulated in the effects analysis as follows:

**Negligible:** An action that would affect only a few individuals of an abundant wildlife population within Sunset Crater Volcano National Monument.

- Minor:** An action that would affect a relatively small number of individuals of an abundant wildlife population or affect a relatively small area of wildlife habitat within Sunset Crater Volcano National Monument. The change would either be very localized in area or the total number of animals affected would be so small that it would have no perceptible consequence to the entire wildlife population or total available wildlife habitat within the monument.
- Moderate:** An action that would affect: (1) a relatively large proportion of individuals of wildlife populations or relatively large habitat area; (2) the existing dynamics between wildlife species that occur in association with each other (for example, natural predator-prey relationships and inter-species competition); or, (3) a relatively large area of available wildlife habitat within Sunset Crater Volcano National Monument. A wildlife population or habitat type might be permanently altered, but all affected species and habitats would remain indefinitely viable within the monument.
- Major:** An action that would affect most or all of entire wildlife populations or available habitat, or fully disrupt natural dynamics between wildlife species within Sunset Crater Volcano National Monument.

### Impacts of Alternative A (No Action Alternative)

Cumulative Effects: Under the No-Action Alternative, access roads, parking, trails, and visitor-support facilities within the monument would continue to occupy and directly impact approximately 130 acres, or less than 5% of the total available wildlife habitat within the monument. Motor vehicle traffic would continue along the Scenic Loop Road, with undetermined numbers of various wildlife species killed while crossing the road. Overall traffic volumes, peak levels, and speeds are low enough that, while some animals are killed, the road does not significantly fragment wildlife habitat. Motor vehicle noise along roads and at parking areas would continue to disturb various species of wildlife, depending upon their respective levels of tolerance of noise, up to ¼ mile along the road corridors. Visitor activities, and associated noise and human disturbance impacts to various wildlife species would remain concentrated around the Lava Flow Trail and the Lenox Crater Trail areas.

Conclusion: Approximately 95% of the monument area would remain within the Resource Preservation Zone, closed to general public access in order to protect unique and fragile volcanic resources. Impacts to wildlife species and habitats within this zone would remain limited to NPS administrative and management actions, such as wildfire suppression under the Fire Management Plan (NPS 2008), resource inventory and monitoring, and resource protection patrols. Other access would remain restricted to Native American traditional activities, or other authorized scientific, educational, and special uses under NPS permits. Other than noise disturbance from motor vehicle traffic within this zone, wildlife species and habitat would continue to be protected from disturbance.

### Impacts of Alternative B (GMP Trail Implementation)

Under Alternative B, the current access road and parking areas within the monument would continue to be used, and associated wildlife mortality, habitat fragmentation, and noise related impacts would be the same as the same as the No Action Alternative. Most visitor activities and associated human presence and noise disturbance to various wildlife species and available wildlife habitat would remain concentrated around the Lava Flow Trail and the Lenox Crater Trail areas, the same as the No Action Alternative.

Cumulative Effects: The proposed Monument Trail alignment parallels the existing Scenic Loop Road an area that is mostly barren cinder terrain and barren lava flow surface. No large trees or other important physical wildlife habitat attributes would be measurably altered in constructing the trail. Off-trail visitor activity, such as resting, viewing scenery, photography, picnicking, etc., might increase human presence disturbance to some wildlife species, but this would not be expected to measurably magnify disturbance over that already caused by moving motor vehicles and traffic noise within ¼ mile of the road. The proposed Monument Trail and associated visitor activities may indirectly affect wildlife habitat use of approximately 3.5 acres of sparse ponderosa pine vegetation and lava flow rock outcrops. This action would affect a small number of animals and minute area of total available wildlife habitat within the monument, and is considered to be a long-term, negligible to minor adverse impact.

Conclusion: Under Alternative B, the total wildlife area within the monument impacted by access roads, parking, trails, and visitor-support facilities would increase by less than 5 acres over existing conditions, to a total of 135 acres. This would still be less than 5% of the total area within the monument, the same as the No Action Alternative, and considered to be a long-term, negligible adverse impact to wildlife habitat. The remaining 95% of available wildlife would remain protected within the Resource Preservation Zone, where impacts would remain the same as the No Action Alternative.

### **Impacts of Alternative C (Preferred Alternative)**

Under Alternative C, all existing road access and visitor support facilities would continue to be used, and impacts to wildlife species and habitats would be the same as the No Action Alternative. Visitor activities would primarily remain concentrated around the Lava Flow Trail and the Lenox Crater Trail areas, where associated impacts to wildlife species and habitats would be the same as the No Action Alternative.

The proposed Monument Trail connecting the Visitor Center and Bonito Campground to the Lava Flow Trail would have a long-term, negligible to minor adverse impact, as discussed under Alternative B.

Cumulative Effects: Constructing the proposed Lenox Crater Loop Trail, accessible overlook trail from the existing Lava Flow parking area, and Sunset View Trail would directly impact a total of 0.83 acres of wildlife habitat. The proposed trail alignments are mostly within barren cinder terrain, with some areas having ponderosa pine-sparse shrub understory vegetation. Some small-diameter ponderosa pine trees might be removed to construct the trails, but no large trees or other important physical wildlife habitat attributes would be measurably altered.

The proposed Lenox Crater Loop Trail and accessible overlook trail alignments would be adjacent to the existing Scenic Loop Road, Lenox parking area and existing Lenox Crater Trail, and the Lava Flow parking area. Motor vehicle traffic, human presence, and related noise disturbance to wildlife species is already occurring within ¼ mile of these areas, and wildlife impacts from human presence and noise along the two proposed trails is not expected to measurably increase over current levels. The proposed Lenox Crater Loop Trail would be longer than the existing Lenox Crater Trail, but the proposed loop alignment would remain so close to the existing trail that wildlife disturbance impacts from the new trail would not measurably increase over existing levels. The proposed Lenox Crater Loop and accessible overlook trails would have negligible impacts to wildlife species and long-term, minor impacts to wildlife habitat within the monument.

The Sunset View Trail would closely parallel approximately 1.1 miles of rock outcrop habitat along the southeastern margin to the Bonito Flow. The proposed trail alignment traverses an area that has been closed to general visitor use since 1998. Visitor use on the trail would measurably increase the level of human presence and noise related disturbance over existing levels.

Overall, the proposed new trail system would directly impact approximately 0.83 acres of wildlife habitat within the monument. Associated human presence and noise along the new trail system would measureable increase along the southwestern margin of the Bonito Lava Flow and southeast of Lenox Crater. Wildlife disturbance would mostly occur during the day, while many wildlife species are active at dusk, night, or dawn. The proposed new trail system would result in long-term, minor adverse impacts to wildlife species and habitat within the monument.

Under Alternative C, a new parking area, restroom, and picnic area would be constructed on the south side of the NPS access road, near the northeast base of Lenox Crater. These facilities would be immediately adjacent to the Scenic Loop Road, Lenox parking, and Lenox Trail, where traffic visitor activity noise and related wildlife disturbance are already occurring. The construction and use of the proposed parking and visitor facilities would have negligible impacts to wildlife species and long-term, minor adverse impacts on available wildlife habitat.

Under Alternative C, a program of NPS-guided discovery hikes would be implemented within the proposed Guided Adventure Zone. The total area within the proposed zone is 92.1 acres. Wildlife habitats within this area include barren cinder terrain, basalt rock outcrop, and mature ponderosa pine-sparse shrub understory woodland. No trails or facilities would be constructed, and there would be no direct impacts to wildlife habitat. Under the proposed mitigation for this action, both group size and the number of guided hikes per calendar year would be limited. NPS-guided, off-trail hiking would result in a much lower level of human presence and noise related disturbance to wildlife than current impacts at the heavily visited Lava Flow and Lenox Trail areas. However, because visitor activity would be intermittent, some wildlife species may be more sensitive and startled by guided groups should they be encountered. This action would have long-term, minor adverse impacts to wildlife species and negligible impacts to wildlife habitat within the monument.

Conclusion: Under Alternative C, the total area of wildlife habitat within the monument that is impacted by access roads, parking, trails, visitor-support facilities, and visitor activities would increase from 130 acres under existing conditions to a total of 228 acres, an overall increase from 5% to 7.5% compared to the No Action Alternative. The total impact under this alternative would be long-term, adverse and minor, because available wildlife habitat would be reduced by a small amount, and because human presence and noise disturbance would increase within some areas that are currently un-impacted. The affected wildlife species and habitat would be anticipated to eventually recover should the trails or facilities ever be abandoned and removed. The remaining 93.5% of the monument area would remain within the Resource Preservation Zone, where impacts would remain the same as the No Action Alternative.

## **Special Status Species**

### **Affected Environment**

This section complements the preceding sections on Vegetation and Wildlife, and is intended to address potential impacts to listed or candidate species under the Endangered Species Act, or species which are identified as "species of conservation concern" that are known to occur to potentially occur within Sunset Crater National Monument. The Arizona Heritage Data Management System (Arizona Game and Fish Department 2013) was consulted via the internet to

generate a list of threatened and endangered species, and other species of conservation concern for Coconino County, Arizona. This list was compared to the NPSpecies lists for vascular plants, amphibians, reptiles, birds, and mammals that are reliably documented within Sunset Crater Volcano National Monument (NPS 2013).

*Wildlife.* Currently, no federally listed threatened, endangered, or candidate wildlife species are known to occur in Sunset Crater Volcano National Monument. Currently, no suitable habitat or designated Critical Habitat for Federally-listed species occurs within the monument.

One formerly-listed bird species, the bald eagle, is known to overwinter and roost in large, dead tree snags on the adjacent Coconino National Forest. Bald eagles are occasionally seen soaring in the air over the park, but no roosting has been documented.

One bird species of concern, the northern goshawk (*Accipiter gentilis*), is known to occur on the adjacent Coconino National Forest. In Arizona goshawks prefer forest interior stands of large ponderosa pine trees. Suitable breeding and nesting habitat for the northern goshawk does not occur within the monument. No observations of goshawks have been recorded within the monument, but individual goshawks may occasionally hunt or disperse across the monument. The nearest known documented northern goshawk breeding territory is approximately four miles from the boundary, on much older volcanic terrain that supports mature ponderosa pine habitat.

Drost (2008) documented the occurrence of a number of bat species of concern within the monument, including: western small-footed myotis bat (*Myotis ciliolabrum*), long-eared myotis bat (*Myotis evotis*), fringed myotis bat (*Myotis thysanodes*), and long-legged myotis bat (*Myotis volans*). Other bats that potentially occur include Townsend's big-eared bat (*Corynorhinus townsendii* spp. *pallascens*), Allen's big eared bat (*Idionycteris phyllotis*), Arizona myotis bat (*Myotis occultus*), and big free-tailed bat (*Nyctinomops macrotis*). The bat survey methods only detected them when they were actively foraging for insects at night, and almost nothing is known about their daytime roost habitats within the monument. Presumably these species roost within tree cavities and rock crevices. Because bats are highly mobile, they may also roost in adjacent habitat outside of the monument and only use habitat within the monument to forage.

*Plants.* Currently, no federally-listed threatened, endangered, or candidate plant species are known to occur in Sunset Crater Volcano National Monument. Currently, no suitable habitat or designated Critical Habitat for Federally-listed species occurs within the monument.

Two plant species of concern are known to occur within the monument – the Sunset Crater beard's tongue (*Penstemon clutei*) and cinder ladies tresses (*Phacelia serrata*). Sunset Crater beard's tongue is a short-lived perennial wildflower, endemic to northern Arizona and found within the monument, on surrounding cinder cone volcanoes, and within cinder covered terrain. Cinder ladies tresses is an ephemeral annual species, also endemic to recent volcanic deposits in northern Arizona, but with a slightly larger distribution. Cinder ladies tresses germination and growth is highly variable from year to year, heavily influenced by seasonal moisture patterns. Many years may go by with few plants observed, interspersed with prolific growth in the wettest years. Sunset Crater beard's tongue and cinder ladies tresses have both been surveyed and mapped within the monument (Huisinga et. al. 2000), and by NPS biologists within numerous project areas over the last ten years (on file, Resources Management Division, Flagstaff Area National Monuments). Populations of both species are documented from numerous locations within the monument, including areas of heavy visitor-use adjacent to the Lava Flow Trail and Lenox Crater Trail. Recent studies have shown that Sunset Crater beard's tongue is adapted to fire and other types of

disturbance within ponderosa pine forest (2000 Southwest Rare Plant Conference Proceedings, in press).

### Intensity Level Definitions

Impact topics for special status species that were identified through the public and internal NPS scoping processes include: (1) the direct removal of special status plants while constructing new trails and other facilities; and, (2) increased human presence and noise disturbance to special status wildlife species within the monument; and (3) increased road-related habitat fragmentation and/or vehicle-caused mortality within a special status wildlife species. Intensity of effects are defined as follows.

- Negligible:** An action that would not affect any individuals or habitat of a sensitive species within Sunset Crater Volcano National Monument.
- Minor:** An action that would affect a few individuals of a special status species or have very localized impacts upon special status species habitat within Sunset Crater Volcano National Monument. The change would require considerable scientific effort to measure and have barely perceptible consequences to the species or habitat function.
- Moderate:** An action that would cause measurable effects on: (1) more than a few individuals within a special status species population; (2) natural ecological relationships for a special status species (for example, predator-prey, herbivore-plant forage, vegetation structure-wildlife breeding habitat); or (3) a relatively large habitat area or important habitat attributes for a special status species within Sunset Crater Volcano National Monument. A special status species population or habitat might deviate slightly from normal levels under existing conditions, but would remain indefinitely viable within the monument.
- Major:** An action that would have drastic and permanent consequences for a special status species population, natural ecological relationships, or almost all available critical or unique habitat area within Sunset Crater Volcano National Monument. A sensitive species population or its habitat would be permanently and greatly altered from normal levels under existing conditions.

### Impacts of Alternative A (No Action Alternative)

Under the No-Action Alternative, northern goshawk may occasionally hunt within or disperse through the monument. Second-growth ponderosa pine vegetation would continue growing undisturbed within the monument, perhaps reaching suitable stature for goshawk nesting habitat in 100 to 200 years.

Under the No-Action Alternative, overwintering bald eagles would continue to soar over the monument. Vehicle traffic and visitor activity are typically lower during the winter months, and overwintering bald eagles may rarely perch or roost in large, dead tree snags within the monument.

Cumulative Effects: Under the No-Action Alternative, access roads, parking, trails, and visitor-support facilities within the monument would continue to occupy and directly impact approximately 130 acres of habitat for both Sunset Crater beards tongue and cinder ladies tresses within the monument. Off-trail visitor activities around the Lava Flow Trail and Lenox Crater Trail may occasionally cause trampling of individual plants, but occasional monitoring shows that populations are stable and healthy within these areas.

Conclusion: Approximately 95% of the monument area would remain within the Resource Preservation Zone, closed to general public access in order to protect unique and fragile volcanic resources. Habitat for special status wildlife and plant species would continue to be protected from disturbance within this zone. Overall, this alternative would result in local, long-term, minor, adverse effects.

### **Impacts of Alternative B (GMP Trail Implementation)**

Under the Alternative B, the proposed Monument Trail would be constructed parallel to the Scenic Loop Road, which is not suitable habitat for northern goshawk. Impacts would be the same as the No Action Alternative.

Cumulative Effects: Under the Alternative B, overwintering bald eagles would continue to soar over the monument. Overwintering bald eagles may rarely perch in large, dead tree snags along the Scenic Loop Road, but would not be expected to roost overnight. Visitor activity along the proposed Monument Trail parallel to the Scenic Loop Road may increase human disturbance to a perching along the road corridor. Visitor activity is typically lower during the winter months. This is considered to be an extremely unlikely event, and Alternative B would have negligible impacts to overwintering bald eagles within the area surrounding the monument.

Under Alternative B, no large trees or areas of rock crevices suitable for special status bat species would be removed. Bats are nocturnal and relatively tolerant of human presence and noise, and visitor activity along the proposed trail would not disturb them. This alternative would have negligible impacts to special status bat species.

Conclusion: Prior to construction, the proposed Monument Trail alignment would be surveyed, and any Sunset Crater beard's tongue or cinder ladies tresses plants would be flagged so the trail could be routed to avoid them. Based upon recent surveys, some plants of both species occur along the proposed trail alignment. The proposed Monument Trail would directly impact approximately 0.22 acres of habitat for both plant species. Some off-trail trampling by visitors might occur, but this would be expected to impact only one or a very few individual plants. Such incident would occur only occasionally over very long periods of time, and the impact to overall population numbers would not be measurable with existing scientific monitoring methods. Alternative B would have long-term, minor adverse impacts to the populations of both plant species of concern and to habitat Sunset Crater beard's tongue and cinder ladies tresses.

### **Impacts of Alternative C (Preferred Alternative)**

Under the Alternative C, the proposed Monument Trail would be constructed parallel to the Scenic Loop Road, which is not suitable habitat for northern goshawk. Impacts would be the same as the No Action Alternative.

Alternative C would have negligible impacts to overwintering bald eagles within the area surrounding the monument, as discussed under Alternative B.

Under Alternative C, the proposed trail system, new parking area, and associated visitor facilities would not result in the removal of large, cavity-bearing trees or areas of rock crevices suitable for special status bat species. Bats are nocturnal and relatively tolerant of human presence and noise, and visitor activity along the proposed trail would not disturb them. This alternative would have negligible impacts to special status bat species.

The proposed Monument Trail would have a long-term, minor adverse impacts to plant species of concern, as discussed under Alternative B.

Prior to construction of the remainder of the proposed new trails under Alternative C, the alignments for the Lenox Crater Loop Trail, accessible would be surveyed, and any Sunset Crater beards tongue or cinder ladies tresses plants would be flagged so the trail could be routed to avoid them. Based upon recent surveys, some plants of both species occur along some segments of proposed trail alignments.

Cumulative Effects: Overall, the proposed new trail system would directly impact approximately 1.05 acres of habitat for both special status plant species within the monument. Some off-trail trampling by visitors might occur, but this would be expected to impact only a very few individual plants. Such incidents would occur occasionally over long periods of time, and the impact to overall population numbers would not be measureable with existing scientific monitoring methods. Based upon monitoring in existing area with intensive visitor activity, populations of both sensitive plant species would be expected to remain stable and healthy. This action would have long-term, minor adverse impacts to the populations of both plant species of concern, and to habitat Sunset Crater beards tongue and cinder ladies tresses within the monument.

The proposed new parking area and visitor use facilities adjacent to the existing Scenic Loop Road and Lenox Crater Trail was recently surveyed for both Sunset Crater beards tongue and cinder ladies tresses (Schelz 2012). Neither occurred within this area, and no plants would be impacted under this action. Approximately 1.0 acres of habitat for both species would be directly impacted by constructing these facilities. This action would have no impacts to individual plants or populations, and would have a long-term, minor adverse impact on habitat for Sunset Crater beards tongue and cinder ladies tresses within the monument.

Under Alternative C, a program of NPS-guided discovery hikes would be implemented within the proposed Guided Adventure Zone. The total area within the proposed zone is 92.1 acres. Both Sunset Crater beards tongue and cinder ladies tresses are known to occur within this area. No trails or facilities would be constructed, and there would be no direct habitat impacts. Under the proposed mitigation for this action, both group size and the number of guided hikes per calendar year would be limited, and indirect effects from guided group hikes on habitat are considered negligible. NPS-guides would be trained in the identification of both plant species so they could be avoided. Both species are easily identifiable. Incidents of trampling by visitors would be expected to be very rare and not result in the mortality of the impacted plants. This action would have long-term, negligible to minor adverse impacts to Sunset Crater beards tongue and cinder ladies tresses populations, and negligible impacts to habitat for Sunset Crater beards tongue and cinder ladies tresses within the monument.

Conclusion: Under Alternative C, the total area of habitat for special status species within the monument that is impacted by access roads, parking, trails, visitor-support facilities, and visitor activities would increase from 130 acres under existing conditions to a total of 228 acres, an overall increase from 5% to 7.5% compared to the No Action Alternative. The total impact under this alternative would be long-term, adverse and minor, because available habitat would be reduced by a small amount, and because the possibility of rare incidents of human trampling of special status plants would increase within some areas that are currently un-impacted. The affected habitat would be anticipated to recover relatively quickly should the trails or facilities ever be abandoned

and removed. The remaining 93.5% of the monument area would remain within the Resource Preservation Zone, where impacts would remain the same as the No Action Alternative.

## Aesthetics

Proposed developments adjacent to and within NPS lands concern area residents, monument visitors and adjacent property owners. Visitors and the local community often identify aesthetics and viewsheds of monuments in the Flagstaff area as important issues. While difficult to maintain natural conditions within heavily visited areas at the monument, NPS does aim to ensure that its actions reduce the visual impacts of their projects to manageable levels. Because actions from this project may create new features on the landscape, the impacts from each alternative are considered below.

### Intensity Level Definitions

- Negligible:** Aesthetics of the monument would not be affected or changes in aesthetics would be below or at the level of detection. Any effects would be short-term. The visitor would not likely be aware of the effects associated with the alternative.
- Minor:** Changes in aesthetics would be detectable, although the changes would be slight and likely short-term. The visitor would be aware of the effects associated with the alternative, but the effects would be slight.
- Moderate:** Changes in aesthetics would be readily apparent and likely long-term. The visitor would be aware of the effects associated with the alternative, and would likely be able to express an opinion about the changes.
- Major:** Changes in aesthetics would be readily apparent and have substantial long-term consequences. The visitor would be aware of the effects associated with the alternative, and would likely express a strong opinion about the changes.

### Impacts of Alternative A (No Action Alternative)

Under the No Action Alternative, existing trails would continue to operate in their current capacities. While no new trails or modifications to the landscape would occur, increases in visitation to the monument would increase crowding on existing roads and trails. Visitors would be concentrated in confined areas, increasing the rate of off-trail excursion to avoid crowded situations. Social trails would proliferate affecting the visual quality of the landscape. These impacts would result in indirect, long-term, minor to moderate, adverse effects to the aesthetic qualities of the monument.

Cumulative Impacts: As the visitation at the monument increases, demand for recreation areas would also increase, bringing with it a greater potential for crowding and visitor use conflicts on monument trails. With increasing visitation, social trails would be expected to increase in use and number. The cumulative impact on users would vary depending on the growth/expansion of the area trails and access points and the quality of these trails. Given the current number and length of trails in the monument and surrounding area, the incremental impact of not constructing new trail segments under this alternative would have long-term, minor to moderate, adverse impacts to the aesthetic quality of the monument.

Conclusion: With no construction proposed, this alternative would have no effect to the aesthetics of the monument; however, in the long-term, visitors would continue using the existing trail system which may lead to inappropriate off-trail use. These adverse impacts are expected to be long-term and minor or moderate in degree. With the growing number visitors to the monument and the

few trails in the surrounding area, this incremental impact of not constructing the trail system under this alternative would have minor to moderate impacts on all visitors.

### **Impacts of Alternative B (GMP Trail Implementation)**

Alternative B would construct one new trail from the Bonito Campground to the Lava Flow Trail. No additional modifications to the landscape would occur under this alternative. During the trail construction, the project would create short-term, negligible impacts to aesthetics in the area. The implementation of the new trail segment would have beneficial impacts to aesthetics since overcrowding and vehicle use would be reduced on existing monument infrastructure by spreading visitation to additional areas of the monument. The overall impacts of Alternative B would be long-term, minor, and beneficial to the aesthetic qualities of the monument.

Cumulative Impacts: As the visitation at the monument increases, demand for recreation areas would also increase, bringing with it a greater potential for crowding and visitor use conflicts on monument trails. With increasing visitation, social trails would be expected to increase in use and number. The cumulative impact on users would vary depending on the growth/expansion of the area trails and access points and the quality of these trails. Given the current number and length of trails in the monument and surrounding area, the incremental impact of constructing this new trail segments under this alternative would have long-term, minor, beneficial impact to the aesthetic quality of the monument.

Conclusion: Impacts associated with the construction of the new trail segment would create short-term, negligible impacts to aesthetics due to the minimal amount of construction equipment needed to build the trail. There would be local, long-term, minor, beneficial impacts to aesthetics once the trail construction is complete.

### **Impacts of Alternative C (Preferred Alternative)**

Alternative C would construct approximately 8 miles of new trails connecting the monument's administrative area and the Bonito Campground with popular attractions at the monument. Minor facilities such as vault toilets, benches and picnic areas would be constructed near new trail segments. During the trail construction, the project would create short-term, negligible impacts to aesthetics in the area. The implementation of the new trail segment would have beneficial impacts to aesthetics since overcrowding and vehicle use would be reduced on existing monument infrastructure by spreading visitation to additional areas of the monument. The overall impacts of Alternative C would be long-term, moderate, and beneficial to the aesthetic qualities of the monument.

Cumulative Impacts: As the visitation at the monument increases, demand for recreation areas would also increase, bringing with it a greater potential for crowding and visitor use conflicts on monument trails. With increasing visitation, social trails would be expected to increase in use and number, and over-use of existing trails would continue. The cumulative impact on users would vary depending on the growth/expansion of the area trails and access points and the quality of these trails. Given the current number and length of trails in the monument and surrounding area, the incremental impact of constructing this new trail segments under this alternative would have local, long-term, moderate, beneficial impact to the aesthetic quality of the monument.

Conclusion: Impacts associated with the construction of the 8 miles of new trails would create short-term, negligible impacts to aesthetics due to the minimal amount of construction equipment

needed to build the trail. There would be local, long-term, moderate, beneficial impacts to aesthetics once the trail construction is complete.

## Visitor Use and Experience

The methodology used for assessing impacts to visitor use and experience is based on how construction of new trails would affect the visitor, including safety considerations and maintaining the resources for future generations to enjoy. Annual visitation counts and census data were used to estimate the effects of the alternative action on visitors. The impact on the ability of the visitor to experience a full range of park resources was analyzed by examining the resources mentioned in the monument significance statement and comments received from visitors and staff.

### Intensity Level Definitions

- Negligible:** Visitors would not be affected or changes in visitor use and/or experience would be below or at the level of detection. Any effects would be short-term. The visitor would not likely be aware of the effects associated with the alternative.
- Minor:** Changes in visitor use and/or experience would be detectable, although the changes would be slight and likely short-term. The visitor would be aware of the effects associated with the alternative, but the effects would be slight.
- Moderate:** Changes in visitor use and/or experience would be readily apparent and likely long-term. The visitor would be aware of the effects associated with the alternative, and would likely be able to express an opinion about the changes.
- Major:** Changes in visitor use and/or experience would be readily apparent and have substantial long-term consequences. The visitor would be aware of the effects associated with the alternative, and would likely express a strong opinion about the changes.

### Impacts of Alternative A (No Action Alternative)

Under this alternative, there would be no new trails constructed and the Lenox Crater Trail would not be modified or obliterated. Without any construction activities, there would be no construction-related impacts such as noise and dust, and the visitor experience would remain the same. Existing uses on the trails within the monument would remain the same.

Visitors would continue to access the trails from the current trailheads, requiring vehicle transportation throughout the monument. The trail system would continue to operate, occasionally exceeding the designed capacity of the trails. Projected increases in visitation also indicate visitors would continue to experience excess traffic both on roads and trails. In addition, Lenox Trail would continue to erode affecting visitor enjoyment and safety. Impacts to visitor use and experience would be indirect, local, negligible to minor, long-term, and adverse.

Examples of certain volcanic features which are integral to the story of the Sunset Eruption would remain within the Resource Preservation Zone, where visitors would be prohibited from directly experiencing them. However, the NPS could develop other forms of off-site interpretation and education.

Cumulative Impacts: As the visitation at the monument increases, demand for recreation areas would also increase, bringing with it a greater potential for crowding and visitor use conflicts on monument trails. With increasing visitation, social trails would be expected to increase in use and

number. The cumulative impact on users would vary depending on the growth/expansion of the area trails and access points and the quality of these trails. Given the current number and length of trails in the monument and surrounding area, the incremental impact of not constructing new trail segments under this alternative would have local, long-term, negligible to minor impacts to monument visitors.

Conclusion: With no construction, this alternative would have no effect to the visitor experience; however, in the long-term, visitors would continue using the existing trail system which may lead to impacts to visitor safety, the visual setting, and visitor enjoyment. These adverse impacts are expected to be long-term and minor in degree. With the growing number visitors to the monument and the few trails in the surrounding area, this incremental impact of not constructing the trail system under this alternative would have negligible to minor impacts on all visitors.

### **Impacts of Alternative B (GMP Trail Implementation)**

Under this alternative, recreational, educational, and interpretive opportunities would be slightly enhanced with the creation of a trail from the Bonito Campground to the Lava Flow Trail. No picnic areas, benches or others facilities would be installed under this alternative. Implementation of this trail would accomplish several of the objectives identified in the *Purpose and Need*; however, it does not correct the unsustainable trail design of the Lenox Crater Trail.

Visitors would be able to hike from the Visitor Center and Bonito Campground to the Lava Flow Trail and the Lenox Crater Trail areas. This would reduce fossil fuel use and greenhouse gas emissions by a negligible amount compared to current total statistics for the United States, but would be considered by most visitors to be a long term beneficial impact on their experience at the monument.

During the trail construction process, impacts to visitor use and experience may occur, but these impacts would be short-term and negligible. One trail would be constructed from the monuments western boundary following the north side of Forest Road 545 to the Lava Flow Trail. During the trail construction, visitors would not be allowed to use the new trails until they were completed. The creation of this new trail would create long-term, beneficial impacts to visitor use and experience. However, the impacts by not improving or obliterating the Lenox Crater Trail would cause long-term, minor adverse impacts to visitor use and experience.

Examples of certain volcanic features which are integral to the story of the Sunset Eruption would remain within the Resource Preservation Zone, where visitors would be prohibited from directly experiencing them, although the NPS could develop other forms of off-site interpretation and education.

Cumulative Impacts: The overall cumulative effect to visitor use and experience would be long-term beneficial and minor. Given the continued growth and use of trails in the monument and surrounding area, the incremental impact of construction the trail from Bonito Campground to the Lava Flow Trail under this alternative would have negligible to minor impacts on all monument visitors. The Lenox Crater Trail would experience long-term, minor, adverse effects if left in its current alignment.

Conclusion: Construction of the new trail connection between the Bonito Campground and the Lava Flow Trail would have short-term, minor, adverse effect to visitors from noise and dust. Beneficial effects of this alternative include increased visitor opportunities from construction a new trail, and enhanced visitor experience from provided non-motorized recreational opportunities.

Cumulatively, this alternative would provide long-term, minor, beneficial impacts to visitor use and experience.

### **Impacts of Alternative C (Preferred Alternative)**

Under the Preferred Alternative, recreational, educational, and interpretive opportunities would be enhanced throughout the monument. Pedestrian trails and a Guided Adventure Zone would be designed and implemented to provide access to important natural resources within the monument. The Preferred Alternative would provide a seamless trail system that would connect the monument's administrative area, USFS campground, and monument attractions, providing a cohesive interpretive experience. This alternative would result in long-term, moderate, beneficial effect to visitor use and experience.

Visitors would be able to hike from the Visitor Center and Bonito Campground to the Lava Flow Trail and the Lenox Crater Trail areas. This would reduce fossil fuel use and greenhouse gas emissions by a negligible amount compared to current total statistics for the United States, but would be considered by most visitors to be a long term beneficial impact on their experience at the monument.

Benches and picnic areas would be installed within the new trail corridors to offer additional visitor use areas and provide areas of increase solitude. Dust, noise, and area closures during construction activities would result in a short-term, negligible to minor, localized, adverse impact on visitor use and experience, but these impacts would be ephemeral and the overall visitor use and experience would be enhanced from the project.

Cumulative Impacts: When considered with other ongoing projects at the monument, the preferred alternative would enhance the recreational, educational, and interpretive opportunities available at the monument. Cumulatively, the Preferred Alternative would result in an overall minor to moderate, long-term, beneficial effect on visitor use and experience.

Conclusion: The construction of the proposed trails, benches, and picnic areas, the modification of management zones within the monument, and the establishment of Discovery Hikes in the Guided Adventure Zone would result in short-term, adverse impacts, and long-term, beneficial effects. During construction activities, there would be a temporary, negligible to minor, localized adverse impact on visitor use and experience from dust, noise, and area closures. Under the Preferred Alternative, the recreational, educational, and interpretive opportunities at the monument would be enhanced resulting in a long-term, minor to moderate, beneficial effect on visitor use and experience. Cumulatively, the Preferred Alternative would result in an overall minor to moderate, long-term, beneficial effect on visitor use and experience.

## CONSULTATION AND COORDINATION

### Internal Scoping

Internal scoping was conducted by an interdisciplinary team of professionals from the Flagstaff Area National Monuments. Interdisciplinary team members met on March 2012 and January 2013 to discuss the purpose and need for the project; various alternatives; potential environmental impacts; past, present, and reasonably foreseeable projects that may have cumulative effects; and possible mitigation measures. The team also gathered background information and discussed public outreach for the project. Over the course of the project, team members have conducted individual site visits to view and evaluate the proposed construction site. The results of these meetings are documented and housed within the administrative file for this EA.

### External Scoping

External scoping was conducted to inform the public about the proposal to construct a new trail system and amend the General Management Plan (2002) at Sunset Crater Volcano National Monument and to generate input on the preparation of this Environmental Assessment. This effort was initiated with the distribution of a scoping letter, which was bulk-mailed to 59 individuals and organizations on February 9, 2012. All adjacent landowners on the monument's mailing list database were included in the mailing. In addition, the scoping letter was sent to local news organizations, and it was posted on the Public, Environment and Public Comment system (PEPC). With this press release, the public was given 30 days to comment on the project.

During the scoping period, one response was received from the public through letters. The response was neutral with regards to constructing a new trail system and had no objections to the proposed project, and requested to be kept informed of the project's progress.

### Agency Consultation

Because portions of the trail system would be constructed on United States Forest Service lands, the Coconino National Forest was invited on January 2, 2013 to be a cooperating agency in the preparation of this Environmental Assessment. The Flagstaff Ranger District of the Coconino National Forest accepted the invitation on January 10, 2013.

In accordance with Section 106 of the National Historic Preservation Act, the National Park Service will provide the Arizona State Historic Preservation Officer an opportunity to comment on the effects of this project. The NPS anticipates a "no adverse effect" determination under §106 of the National Historic Preservation Act.

### Native American Consultation

Thirteen Native American tribes who claim traditional association with the monument were contacted at the beginning of this project, and subsequently after the development of the alternatives, to determine if there were any ethnographic resources in the project area and if they wanted to be involved in the environmental compliance process. The 13 tribes include:

- Fort McDowell Yavapai Nation
- Havasupai Tribe
- The Hopi Tribe
- Hualapai Tribe
- Kaibab Band of Paiute Indians
- Navajo Nation
- Pueblo of Zuni
- San Carlos Apache Tribe
- San Juan Southern Paiute Tribe
- Tonto Apache Tribe

- White Mountain Apache Tribe
- Yavapai-Apache Nation
- Yavapai-Prescott Tribe

Three tribes responded; the Hopi Tribe, the Navajo Nation, and the White Mountain Apache Tribe. All three tribes affirmed their association with the project area and stated that they do not anticipate impacts to Native American sites or resources; however, the Hopi Tribe requested to schedule an administrative meeting to discuss the project further. The Navajo Nation and the White Mountain Apache Tribe indicated they had no objection to the proposed project, and requested to be kept informed of the project's progress, including immediate notification if Native American materials are discovered during construction.

## Environmental Assessment Review and List of Recipients

The Environmental Assessment will be released for public review in June 2013. To inform the public of the availability of the Environmental Assessment, the National Park Service will publish and distribute a letter or press release to various agencies, tribes, and members of the public on the monument's mailing list, as well as place an ad in the local newspaper. Copies of the Environmental Assessment will be provided to interested individuals, upon request. Copies of the document will also be available for review at the monument's Visitor Center and on the internet at <http://parkplanning.nps.gov/sucrtrails>.

The Environmental Assessment is subject to a 30-day public comment period. During this time, the public is encouraged to submit their written comments to the National Park Service, as described in the instructions at the beginning of this document. Following the close of the comment period, all public comments will be reviewed and analyzed, prior to the release of a decision document. The National Park Service will issue responses to substantive comments received during the public comment period, and will make appropriate changes to the Environmental Assessment, as needed.

## List of Preparers

The following persons assisted with the preparation of the Environmental Assessment. All are employees of the National Park Service at the Flagstaff Area National Monuments, Flagstaff, Arizona:

- Diane Chung, Superintendent
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- Joshua Kleinman, Planning and Compliance Program Manager, M.A. Archeology
- Caleb Waters, Maintenance Mechanic Supervisor
- Matt Snider, Trails Foreman

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