Dolly Sods Wilderness Ordnance Removal Project Environmental Assessment—Final

September 8, 1995

Prepared for

the U.S. Army Corps of Engineers
Huntington District
Huntington, WV

in cooperation with

the USDA Forest Service
Monongahela National Forest
Elkins, WV

Abstract: The U.S. Army Corps of Engineers proposes an ordnance and explosive waste removal action at the Dolly Sods Wilderness to reduce the risk to the public, wildlife, and to the environment from the uncontrolled detonation of unexploded ordnance. This Environmental Assessment addresses the impact of the remediation alternatives.

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FINDING OF NO SIGNIFICANT IMPACT
DOLLY SODS WILDERNESS ORDNANCE REMOVAL PROJECT

1. I have conducted an environmental assessment, in the overall public interest, concerning implementation of the Dolly Sods Wilderness Ordnance Removal Project. The purpose of this project is to reduce the risk to the public, wildlife, and to the environment from the uncontrolled detonation of unexploded ordnance.

   The project is authorized as part of the Defense Environmental Restoration Program (DERP) as described in Section 160, Environmental Restoration of Comprehensive Environmental Response Compensation and Liability Act (CERCLA). One of the goals of this program is the "correction of other environmental damage (such as detection and disposal of unexploded ordnance) which creates an imminent and substantial endangerment to the public health or the environment." The U.S. Army Corps of Engineers was designated as the executive agent for the Department of Defense in implementing the program. The program is administered by the Ordnance and Technical Program Division of the U.S. Army Corps of Engineers, Huntsville Division, Huntsville Alabama. The environmental assessment is administered by the Huntington District, Huntington, West Virginia.

2. An assessment was conducted by the Huntington District to evaluate the potential environmental, cultural, and social well-being impacts of the proposed ordnance removal action within the Dolly Sods Wilderness. Consideration was given to public safety, environmental effects, cultural effects, wilderness use and preservation, local public opinion, and compliance with federal, state, and local regulations. The proposed alternative actions and mitigation plans were evaluated regarding potential impacts, either beneficial or adverse. The project was also reviewed to confirm that it met the needs of public for which it was proposed.

3. Three alternatives were considered.

   Alternative 1 - Searching 20 feet on each side of Forest Service designating hiking trails, and detonating ordnance in place. Searching Forest Service inventoried campsites and detonating ordnance in place. This alternative would involve approximately 105 acres. This is the selected alternative.

   Alternative 2 - Searching 20 feet on each side of Forest Service designated hiking trails, and detonating ordnance in

place. This alternative would involve 103.8 acres. This would be no search of campsites.

Alternative 3 - No action-No search for ordnance. Disposal of ordnance found and reported by users of Dolly Sods.

Other alternatives considered in the very early stages of the project, such as searching and clearing the entire wilderness area, deemed too aggressive for a wilderness area by the Forest Service and were not evaluated in the Environmental Assessment. The three alternatives are considered by the managers of the wilderness, i.e., the Forest Service, to be appropriate for the area.

4. An evaluation of the impacts of the selected alternative produced the following conclusions:

a. Environmental Considerations. The Huntington District has taken reasonable measures to assemble and present the known or foreseeable environmental impacts of the project. The Environmental Assessment has been prepared in accordance with the National Environmental Policy Act (NEPA) and Army Regulations (AR) 200-2. The environmental considerations include potential impacts in the following issue areas:

- botanical resources,
- zoological/wildlife resources,
- wilderness resources,
- environmental resources-air quality,water quality,soils,noise,
- cultural resources,
- socioeconomic resources, and
- public safety.

In addition to the Environmental Assessment, a Biological Assessment was prepared by Dr. Tom Pauly of Marshall University to provide a more detailed evaluation of potential impact on biological species of concern.

Detailed procedures have been developed to mitigate all potentially adverse effects of the project. As a result, it has been concluded by experts contributing to the Environmental Assessment that adverse effects resulting from project implementation will be insignificant. F Furthermore, in a review by the United States Fish and Wildlife Service, it is concluded that"... the proposed project is not likely to adversely affect" endangered, threatened, and sensitive species.

b. Social Well-Being Considerations. Analysis of cultural, social, and economic issues were conducted. The project will have a positive impact on cultural resources, as a survey will be conducted to identify potential sites of significance prior to removal of ordnance, and sites identified during ordnance removal will be evaluated by an archaeologist. Such an evaluation would not be undertaken if the project were not to occur.

From a special perspective, the project will have a positive impact. Ordnance presents a significant risk to public safety. Its presence and potential for harm are not readily recognizable by the public. Clearance of ordnance from trails and campsites will ensure that wilderness users will have a safe area. Access to one of the most popular and accessible wilderness areas in the east will be maintained.

From an economic perspective, the project will have no short-term impact. In the longer term, the ordnance removal project will have a positive economic impact. With ordnance removed from trails and campsites, the United States Forest Service will be able to allocate its maintenance funds in a fashion that would otherwise not be possible.

For example, with ordnance removed from trails and campsites, crews will be able to work on trail maintenance projects without attempting to locate ordnance first. Work will proceed more quickly, and therefore, limited funds for such activities will be stretched further.

c. Coordination With Resource Agencies. In accordance with the Fish and Wildlife Coordination Act and the Endangered Species Act, there has been coordination with the United States Fish and Wildlife Service. Other agencies consulted included the West Virginia State Historic Preservation Office, the West Virginia Department of Environmental Protection, the West Virginia Division of Natural Resources, and the United States Department of Agriculture Forest Service.

The Dolly Sods Wilderness is part of the Monogahela National Forest. It is managed by the USDA Forest Service. Since the inception of the project in 1991, the U.S. Army Corps of Engineers has closely coordinated all activities with responsible Forest Service officials.

d. Other Pertinent Compliance. No prime or unique farmland under

the Farmland Protection Policy Act (FPPA) would be involved. The project is also in compliance with the National Historic Preservation Act, (Section 106 - 36 CFR 800), Executive Order 11988 (Floodplain Management), and Executive Order 11990 (Protection of Wetlands).

e. Other Public Interest Considerations. No opposition to the Ordnance removal project has been expressed by the state or local governments or organized environmental groups, and there are no unresolved issues regarding the implementation of the project.

5. I find the Dolly Sods Wilderness Ordnance Removal Project has been planned in accordance with current authorization as described in the Environmental Assessment. The project is consonant with national policy, statutes, and administrative directives. This determination is based on thorough analysis and evaluation of the project and alternative courses of action. In conclusion, I find the proposed Dolly Sods Wilderness Ordnance Removal Project will have no significant adverse affect on the quality of the human and/or natural environmental.

15 Sep 95
DATE

Richard W. Jemiola
RICHARD W. JEMIOLA
Colonel, Corps of Engineers
District Engineer

CONCURRENCE:

22 Sept 95
DATE

for JIM PAGE
Supervisor
Monangahela National Forest

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1.0 EXECUTIVE SUMMARY

1.1. Introduction

This Environmental Assessment has been developed by the U.S. Army Corps of Engineers to evaluate the potential impacts of a proposed ordnance removal action within the Dolly Sods Wilderness. Consideration is given to public safety, environmental effects, wilderness use and preservation, local public opinion, and compliance with federal, state, and local regulations. The proposed alternative actions and mitigation plans are evaluated regarding potential environmental impacts, either beneficial or adverse.

1.2. Purpose of Project

The 10,215-acre Dolly Sods Wilderness located in Tucker, Randolph, and Grant counties in West Virginia was part of the West Virginia Maneuver Area during World War II. The area was used to train infantrymen to fire artillery and mortars. Even though the area was searched and cleared by military explosive ordnance teams after the war, at least 20 pieces of ordnance have been found in recent years. One individual was severely wounded, and several near misses have occurred. The latest occurrence of live ordnance being found was during the 1994 bear hunting season. Unexploded munitions present an imminent and present danger to the public welfare. Therefore, the Department of Defense (DOD) intends to remove unexploded ordnance. The U.S. Army Corps of Engineers has been designated as the organization responsible for environmental restoration of formerly used defense sites, such as Dolly Sods Wilderness. There is an on-going, nationwide program.

The Dolly Sods Wilderness is part of the Monongahela National Forest. It is managed by the United States Department of Agriculture (USDA) Forest Service through its Potomac Ranger District, Petersburg, West Virginia. The U.S. Army Corps of Engineers has developed a plan for ordnance removal, and will manage any such removal. Work will be conducted by unexploded ordnance (UXO) specialists under contract to the Corps of Engineers. The Forest Service has provided input to the ordnance removal plan regarding issues related to forest management and wilderness area management practices. The U.S. Fish and Wildlife Service, the West Virginia Division of Natural Resources, and the West Virginia Department of Environmental Protection have provided input related to botanical and zoological species of concern, and environmental protection issues.

1.3. Alternatives

A feasibility study was conducted in 1991 to characterize the nature and extent of ordnance present. Approximately 281 acres considered most likely to have been used as targets or to contain undershots or overshots were searched. A surface sweep (within 6 inches of the surface) was conducted on 281 acres; 7 rounds of unexploded ordnance were found. A

subsurface sweep (deeper than 6 inches below the surface) was conducted on 10.5 acres; 6 rounds were unearthed. A total of 13 rounds of ordnance were found.

Ordnance included 57 mm armor piercing, 60 mm high explosive, and 81 mm white phosphorus rounds. Records indicate that 81 mm, 105 mm, and 155 mm artillery shells were fired in the area so there is a reasonable expectation that they may also be present.

Based on findings from the feasibility study, the Department of Defense determined that it is an unacceptable risk to allow heavily used areas to remain as potentially contaminated sites. The wilderness area contains 10,215 acres and, because of its large size and the extremely rugged terrain, remediation of the entire wilderness area would be an extremely difficult and expensive proposition. More importantly, since Dolly Sods is a wilderness area, maintenance of the "area where the earth and its community of life are untrammeled by man," is paramount. If the entire wilderness area were cleared of ordnance, it is likely that difficulties would arise due to the existence of endangered and threatened species in sections of the wilderness and the necessity of excavating metallic contacts or clearing areas of underbrush.

Furthermore, it was established from the previous site investigation that certain regions of the wilderness area are extremely unlikely to contain ordnance. For these reasons, the remediation of the entire wilderness area is not considered to be a feasible option. The Corps of Engineers has attempted to determine the level of remediation which is appropriate for the ordnance contamination, and to identify the locations where this remediation would be of the greatest benefit.

Alternatives currently considered include:

- Alternative 1—Searching 20 feet on each side of Forest Service designated hiking trails, and detonating ordnance in place. Searching Forest Service inventoried campsites and detonating ordnance in place. This alternative would involve approximately 105 acres. This is the selected alternative.

- Alternative 2—Searching 20 feet on each side of Forest Service designated hiking trails, and detonating ordnance in place. This alternative would involve 103.8 acres. There would be no search of campsites.

- Alternative 3—No Action—No search for ordnance. Disposal of ordnance found and reported by users of Dolly Sods.

Other alternatives considered in the very early stages of the project, such as searching and clearing the entire wilderness area, have been deemed too aggressive for a wilderness area. The three alternatives now under consideration are considered by the managers of the wilderness, i.e., the Forest Service, to be appropriate for the area.

Figure 1-1. Fisher Spring Run trail illustrates a portion of the 20.8 miles of trails which will be searched for ordnance. Due to the rocky nature of the soil, craters formed during demolition will be of limited size and not readily observable.

1.4. Work Plan for the Preferred Alternative

Teams of experienced UXO specialists will sweep the trails and campsites (105 acres) using hand-held magnetometers. The sensitivity of the instruments will be set to attempt to differentiate between metal fragments and ordnance, however, a small piece of metal near the surface may give the same signal as a large piece much deeper.

Positive signals considered to be potential ordnance will be excavated by hand, to a depth of 1 foot on trails and to 4 feet at campsites. When specialists believe ordnance may be present, a qualified biologist will search an area 40 feet in radius at night to determine whether the nocturnal Cheat Mountain salamander is present. If salamanders are found, they will be carefully removed, along with associated leaf litter and top soil, before any excavation. After

excavating, if no ordnance is found, the metal fragment will be returned to the hole, it will be filled with excavated material and tamped by foot. Litter from the excavated area will be saved and replaced to minimize disturbance to zoological species. If Cheat Mountain salamanders have been found and removed before excavation, after the excavation is refilled or ordnance is detonated, salamanders and associated ground cover will be returned to their original locations.

If ordnance is found, it will be detonated in place. Based upon location, the ordnance may be covered with earth or sandbags to dampen the noise. The size of the crater created by the explosion will depend on the surrounding material, amount of cover material, and size of the ordnance. Treatment of the crater following explosion of the ordnance will be a function of its size, location, and ecosystem. It may be filled with local materials, and covered with mulch and leaves. It may be left as is. In areas close to streams where erosion may result, a sediment filter will be placed to capture silt prior to entry into streams. From experience gained in the 1991 feasibility study, it is anticipated that few craters will be noticeable.

No motorized vehicles will be used in the wilderness. Pack animals may be used to transport heavy materials. The UXO team will establish a base camp outside of the wilderness. To minimize the impact of the work on recreational users, work will be discontinued during times of high use of the wilderness area, such as weekends, major holidays, and rifle deer hunting season. Due to adverse weather conditions, work cannot be accomplished in winter months. The schedule of work is anticipated to take up to 6 months during spring, summer, and autumn, of 1996. Every effort will be made to complete the project as quickly as possible. The Forest Service will provide an on-site official to monitor quality control to assure protection of wilderness resources. This individual, knowledgeable about the Dolly Sods Wilderness, will represent the Forest Service's management philosophy while providing technical assistance to the Corps of Engineers and UXO professionals as necessary.

1.5. Adverse Impacts of Selected Alternative/Mitigation Action

A good model of potential adverse impacts resulting from ordnance remediation is the Engineering Report of the 1991 feasibility study. It occurred in the same area, during the same season, following the same procedures. Approximately one-third as much acreage will be disturbed by the planned project as by the 1991 study (105 acres versus 281 acres). Impacts should be similar in nature, but fewer, due to the reduced area. Impacts will be the result of a walk through and search of 105 acres of vegetation, excavation to search for ordnance, and detonation of ordnance.

In the 1991 study, 390 metal fragments were found during the surface investigation (up to 6 inches below the surface) and 147 metal fragments were found in the subsurface investigation (deeper than 6 inches below the surface). As shown in Table 1-1, if an extrapolation could be made, a search of 105 acres could lead to discovery of 201 fragments.

Table 1-1
Possible Extrapolation from 1991 Feasibility Study to Proposed Ordnance Removal

	1991 Feasibility Study	Proposed Ordnance Removal
Acres	281	105
Objects Found in Surface Investigation	390	146 (Possible)
Objects Found in Subsurface Investigation	147	55 (Possible)
Total Objects Found	537	201 (Possible)

Again referring to data collected in the 1991 feasibility study, the Corps of Engineers estimates that between 5 and 30 rounds of ordnance may be found. The upper bound is derived from an extrapolation made from the density of ordnance found in an area that served as a practice range. Most of the areas to be searched in the planned project fall outside of practice range areas, with the exception of portions of Red Creek. Therefore, it is anticipated that the amount of ordnance found will fall in the lower end of the range. Up to 570 square feet of land surface may be disturbed by excavation and detonation if 30 rounds of ordnance are located.

Neither the U.S. Army Corps of Engineers nor the Forest Service conducted a formal analysis of the impacts from the 1991 feasibility study. However, the Forest Service reported "minor impacts and disturbances to the vegetation and soils." There was no measurable change to air quality or water quality.

Experience from the 1991 feasibility study shows that due to the rocky nature of much of the surface, generally no crater is formed following detonation. In at least one instance in 1991, partially exposed ordnance was detonated in place. A crater of 1 to 1 1/2 feet in depth was created. It was filled with rocks and soil, and covered with leaf litter. In a reconnaissance by a Forest Service technician in the spring of 1995, that crater was difficult to attribute to ordnance disposal. Because much of Dolly Sods has rough terrain, it is very difficult to differentiate depressions caused by ordnance explosions in the 1991 feasibility study from depressions created by past logging activities, floods, and other acts of nature.

Estimates of potential crater size have been made by ordnance experts. The worst-case crater would be created in wet sandy clay. This could be encountered in areas close to streams, such as around Red Creek. The controlled explosion of a 155 mm shell, the largest that

might be located at Dolly Sods, found at a depth of 1 foot under ground, could create a crater 4.8 feet deep and 10.3 feet in diameter.

One historic archaeological site which was identified at the Dolly Sods Wilderness during the 1991 study was adversely impacted by the study when artifacts were not protected adequately. Therefore, a strong emphasis has been placed on identification and preservation of cultural resources in the work plan for the planned project. An archaeologist will perform initial evaluations of the area prior to work by UXO contractors to identify potential sites, and close overview during the project will be provided by the on-site Forest Service representative. A specialist will be available to visit sites.

In the same vein, strong emphasis has also been placed on documentation of sensitive or rare species, and on practices required for preservation of threatened and endangered species found in the wilderness area, such as the Cheat Mountain salamander. A biological assessment and mitigation plan was developed specifically for the planned ordnance removal project. That plan was reviewed and approved by the U.S. Fish and Wildlife Service, the agency with prime responsibility for the protection of threatened and endangered species.

A summary of environmental impacts and associated mitigation plans is presented in Table 1-2. For each adverse impact, a specific mitigation plan has been developed by the Corps of Engineers working in cooperation with the Forest Service and the Fish and Wildlife Service. Less than 570 square feet of the Dolly Sods Wilderness will be disturbed; credible plans are in place to mitigate all adverse impacts.

The Dolly Sods Wilderness is a place of special beauty. It is the intent of the Corps of Engineers to preserve and protect that special beauty. The ordnance removal project will have no significant impact on the Dolly Sods Wilderness ecosystem. In fact, it will have several positive impacts. Three of the most significant include:

- new detailed topographical maps will be created by the Corps of Engineers, based on aerial surveys of the wilderness. These maps will be available to wilderness managers and users.

- information about locations of rare and sensitive botanical and zoological species and cultural resources will be collected. This information will be made available to knowledgeable experts, the Forest Service, and the West Virginia Division of Natural Resources to contribute to the database of knowledge about the Dolly Sods Wilderness.

- public safety will be enhanced. Closure of the wilderness for public use will not be an issue of consideration.

Table 1-2
Summary of Environmental Consequences and Associated Mitigation

Resource	Action and Effect	Mitigation Measures
Botanical	Walk through 105 acres; disturb up to 570 sq. ft. of vegetation through excavation and detonation; vegetation will return within 1 year. No brush cutting except to access ordnance. No significant impact. Project will document locations of sensitive and rare species. This will contribute to scientific database, a positive impact.	Document location and transplant sensitive species to suitable habitat or reseed as appropriate. Species will be appropriate for site.
Zoological/Wildlife	Walk through 105 acres; mobile species will move during project, then return. Immobile species may suffer incidental taking. No short-term or long-term effect on wildlife. Project will include documentation of locations of sensitive and rare species. This will contribute to scientific database, a positive impact.	Document location of rare, endangered, threatened, and sensitive species. Collect and hold Cheat Mountain salamander prior to excavation and detonation, then replace. During detonation of ordnance, if found in the habitat of the Virginia northern flying squirrel, noise-deadening techniques will be used.
Wilderness	Walk through 105 acres; disturb up to 570 sq. ft. of vegetation. No visual impact. Use of limited areas in the wilderness for recreation will be limited for up to 6 months during ordnance removal. Long-term public safety will be improved. Evidence of human use (ordnance) will be removed. This will be a positive impact. New topographic maps will be created by the Corps of Engineers based on detailed aerial photography of the wilderness. These maps will be available to wilderness users; a positive impact.	Disturbed areas will be remediated for esthetics. Visitors to Dolly Sods Wilderness will be provided with information regarding alternative use areas.
Wetlands	No waterways will be altered. Ordnance found and detonated in wetlands will cause craters to be formed; original configuration will return within two years.	Ordnance found in waterways will be removed then detonated.

Table 1-2
Summary of Environmental Consequences and Associated Mitigation (Continued)

Resource	Action and Effect	Mitigation Measures
Environmental air/water/soils/noise	No air emissions. No aqueous or solid waste emissions. If ordnance is located in waterway, it will be moved and detonated away from stream. Noise (between 5 and 30 detonations of ordnance) may be heard. All equipment is noise-free, so no contribution to ambient noise will be made. No significant impact.	Soil erosion and stream sedimentation will be controlled through proven techniques. Noise will be dampened by covering ordnance with sandbags.
Cultural	Project will include survey to document locations of cultural resources. Survey will contribute to archaeological database, a positive impact.	Archaeologist to conduct complete literature review of historic logging activities and develop comparative file to evaluate potential significance of historic remains; on-site investigation by trained archaeologist to identify cultural remains as necessary.
Socioeconomic	Use levels of the Dolly Sods Wilderness may decline for up to 6 months, during ordnance removal. However, UXO work crews will contribute to area economy. No net impact in the near-term. Long-term impact is positive. Maintenance of trails and campsites can be conducted without first searching for ordnance. Funds can be allocated directly for maintenance rather than for ordnance searches.	UXO teams will work in isolated areas and will limit access to one area at a time. Other areas will remain open to users.
Public Safety	Safety for users will be enhanced, as most users stay on trails and in campsite areas; a positive impact. However, risk remains for those who leave trails and campsites, such as hunters. High risk will remain in the event of a forest fire.	Fire control will be implemented by UXO crews and Forest Service employees. Warning signs will be erected.

2.0 PURPOSE AND NEED FOR PROPOSED ACTION

2.1. Objectives of Environmental Assessment

This Environmental Assessment addresses the environmental impacts of proposed ordnance removal alternatives. Consideration is given to public safety, environmental effects, local public opinion, and compliance with federal, state, and local regulations. The proposed mitigation measures and alternative actions are evaluated regarding potential environmental impacts, either beneficial or adverse.

The objective of this study is to evaluate the potential impacts of the proposed ordnance clearance on the environment. The Environmental Assessment has been prepared in accordance with the National Environmental Policy Act (NEPA) and Army Regulations (AR) 200-2. The environmental considerations include potential impacts in the following issue areas:

- botanical resources,
- zoological/wildlife resources,
- wilderness resources,
- wetlands,
- environmental resources—air quality, water quality, soils, noise,
- cultural resources,
- socioeconomic resources, and
- public safety.

This document is formatted so that each issue area addresses affected environment, environmental consequences, and mitigation measures. Public involvement was integrated into the environmental assessment process so that concerned citizens, as well as affected state and federal agencies could voice their concerns early during the environmental assessment preparation.

This environmental assessment does not address some issues raised by the public: a risk assessment of the No Action Alternative; and a cost-benefit analysis. These issues of concern are not within the scope of the analysis of environmental impacts. Discussions and comments related to such topics should be directed to the U.S. Army Corps of Engineers address found on the front page of this document.

2.2. Purpose of Proposed Action

In cooperation with the U.S. Forest Service the U.S. Army Corps of Engineers proposes an ordnance and explosive waste (OEW) removal action at the Dolly Sods Wilderness to reduce the risk to the public and environment from unexploded ordnance such that the area may continue to be used for wilderness purposes.

A high concentration of ordnance is thought to exist within the Red Creek valley of the wilderness, where campers are commonly found. An estimated 45,000 to 75,000 people visit the Dolly Sods Wilderness each year. It is estimated by the Forest Service that 25,000 people use the wilderness annually for hiking, camping, and hunting. The Forest Service maintains 20.8 miles of trails and has documented 101 commonly used camping areas in the wilderness area.

To locate and remove ordnance, trails will be searched their entire length and 20 feet to each side by unexploded ordnance (UXO) specialists using hand-held ordnance detection devices such as metal detectors. If metal is indicated, the location will be excavated by hand to a depth of 1 foot. Cleared areas used for camping will also be searched and, where metal is indicated, excavated by hand to a 4-foot depth. Small undergrowth, grasses, and fallen trees will be cleared only if necessary to search an area, and only if the area is accessible to hikers, campers, or hunters. Earth will be excavated only if metal objects are detected. Most UXO will not be moved for safety reasons but will be destroyed in place by detonation. If UXO is found in waterways or on extremely sensitive sites, it will be moved prior to detonation if possible.

2.3. Project History

The 10,215-acre Dolly Sods Wilderness, located within Grant, Tucker, and Randolph counties, West Virginia and managed by the U.S. Forest Service, was a part of the 2,181,000-acre West Virginia Maneuver Area during World War II. Even though areas were searched and cleared by military explosive ordnance disposal (EOD) teams after the war, at least 20 pieces of ordnance have been found in recent years. Some of these were found in a 1991 feasibility study by the U.S. Army Corps of Engineers.

The study included searching a sampling of areas considered most likely to have been used as targets or to contain overshots or undershots. Approximately 281 acres of the 10,215 acres were searched with magnetometers and 13 pieces of ordnance, ranging in size, were found from 6 to 24 inches beneath the surface. One piece was found within several feet of a site used as a campfire pit. If the fire had been located over the buried ordnance, there is the likelihood that the ordnance would have detonated, potentially harming several persons. There is also the potential for tent pegs to be driven into buried ordnance or for people to find and pick up pieces of ordnance, creating a hazardous situation.

An investigation to determine the extent of ordnance in the Dolly Sods Wilderness took place from July 29 to October 3, 1991. During the course of the investigation, 13 separate rounds of ordnance were located. Both surface and subsurface investigations were conducted. The surface investigation was completed during a 5-week program that took place from July 29 through August 29, 1991. The investigation was performed as outlined in the *Feasibility Study Dolly Sods Wilderness Area: Final Work Plan for Surface and Subsurface Investigation and On-Site Disposal of Ordnance*, submitted July 19, 1991, by Metcalf &

Eddy, Inc., under contract to the U.S. Army Corps of Engineers, Huntsville Division. More details regarding the feasibility study are available in that report.

As part of the surface investigation, 281 acres were searched and cleared in 1991. (It should be noted that the surface investigation located materials on the surface and less than 6 inches below the surface. Results of the investigation were documented in the *Feasibility Study Dolly Sods Wilderness Area: Engineering Report for Extent of OEW Contamination and Evaluation of Remedial Action Alternatives*, January, 1992, also prepared by Metcalf & Eddy, Inc. Areas were chosen for clearance which were most likely to contain ordnance based on topography and information obtained during the records search and site investigation. These areas were often hilltops, as they were considered likely to have been used as targets. In addition, locations which were considered to be likely to contain undershots from artillery firing at Blackbird Knob were chosen. Finally, several areas were chosen in order to provide a distribution of investigation coverage throughout the wilderness area. The original 16 search areas are shown in Figure 2-1.

Iron bearing rock was discovered in almost every surface clearance area and was common throughout the Dolly Sods Wilderness. Non-ordnance or explosive waste (OEW) materials—railroad spikes, horseshoes, logging chains, tin cans, tent stakes, and other miscellaneous scrap metals—were generally concentrated in areas where past human activities (logging railroads and logging camps), had occurred and present human activities (hiking and camping) take place. Isolated discoveries of non-OEW materials were made throughout the Dolly Sods Wilderness. Ordnance was found in northern Dolly Sods, in the Breathed Mountain region, and in the Red Creek floodplain adjacent to Breathed Mountain. A summary of OEW and non-OEW wastes found during the surface investigation are presented in Table 2-1.

The subsurface investigation was initiated immediately after the surface investigation had been completed. It took place from September 3 to October 3, 1991. The investigation was performed as outlined in the *Feasibility Study Dolly Sods Wilderness Area: Final Work Plan for Surface and Subsurface Investigation and On-Site Disposal of Ordnance*, submitted July 19, 1991. The subsurface clearance was concentrated in areas where mortars had been found during the surface investigation. The subsurface investigation covered a total of 10 1/2 acres.

Non-OEW discoveries that were made during the subsurface investigation were similar to the non-OEW related materials found during the surface investigation. Ordnance was found in northern Dolly Sods and in the Red Creek floodplain near Breathed Mountain. A summary of OEW and non-OEW wastes found during the subsurface investigation are presented in Table 2-2.

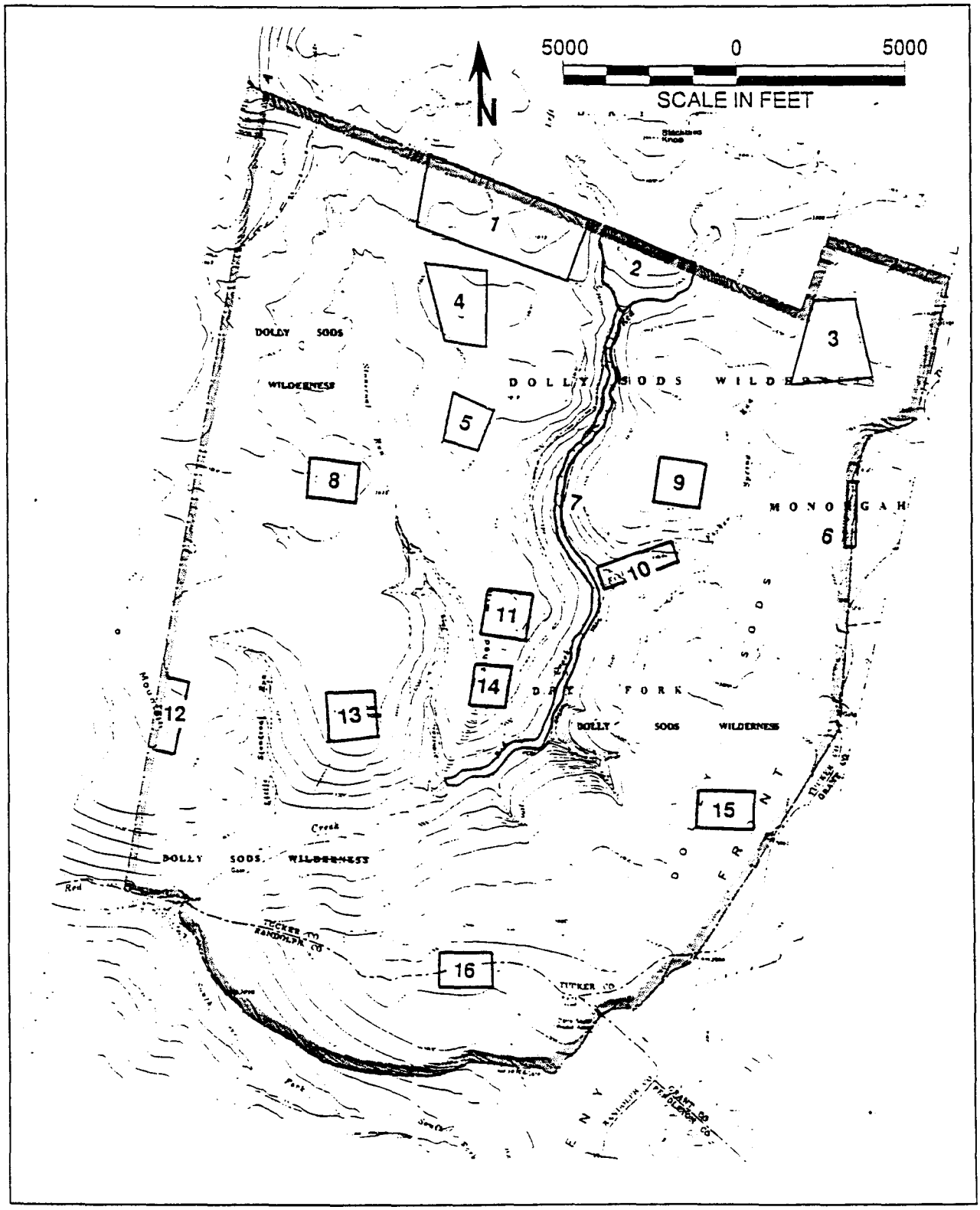


Figure 2-1. Dolly Sods Wilderness search areas studied during 1991 study; 13 rounds of ordnance were located in these areas.

Table 2-1
Materials Discovered During Surface Investigation

Description	Depth	Area
4.2″ high explosive	6″	1
81 mm high explosive	<6″	14
81 mm smoke round	<6″	14
Frag-81 mm smoke round tail fin & boom	<6″	14
Frag-2 81 mm high explosive tail fin & boom frag.	<6″	7
57 mm solid round with tracer ports	<6″	11
60 mm high explosive; boom & fin separate, no fuse	<6″	7
Frag-81 mm smoke round tail fin & boom	<6″	7
81 mm smoke round	<6″	7
Frag-4.2″ sand filled 60-80% complete	<6″	17
Frag-81 mm smoke round tail fin, boom & frag	<6″	7-1
Frag-81 mm smoke round tail fin & boom	<6″	7-1
81 mm smoke round	6″	7-2
Tin Can (1)	<6″	1
Tin Can (1)	<6″	1
Tin Can (4), Tent Stake (5), Railroad Spike (6), Logging Chain (1), Horseshoe (2)	<6″	2
Tin Can (3), Tent Stake (1), Railroad Spike (2), Hand Tool* (2)	<6″	2
Tent Stake (3), Hand Tool* (1)	<6″	4
Tin Can (1), Tent Stake (1)	<6″	5
Tin Can (42), Tent Stake (68), Railroad Spike (107), Iron Bolt (11), Wire Pieces (28), Bobby Pin (2), Fork (1)	<6″	7
Iron Bolt (5), Wire Pieces (8), Fork (2)	<6″	7
Wire Pieces (8)	<6″	10
Logging Chain (1)	<6″	11
Tin Can (3)	<6″	12
Hand Tool* (2)	<6″	14
Tin Can (34), Tent Stake (31), Horseshoe (1), Hand Tool* (1), Bobby Pin (1)	<6″	18

* Hand tools include items such as an iron chisel, knife, grub hook, and garden trowel.

Table 2-2
Materials Discovered During Subsurface Investigation

Description	Depth	Area
81 mm high explosive	<6″	7-2
Frag-81 mm high explosive tail boom		7-4
81 mm smoke round	<6″	7-5
Frag-81 mm tail boom		7-5
Frag-6″ × 8″ fragment from 4.2″ round		1-1
4.2″ smoke round	24″	1-1
4.2″ practice round	18″	1-1
4.2″ practice round	9″	1-2
4.2″ practice round	15″	1-2
Tin Can (1), Tent Stake (2), Trash Piles* (1), Misc. Metal** (1)	N/A	7-1
Tin Can (9), Tent Stake (2), Railroad Spike (2), Iron Bolt (1), Axe Head (1), Cable and Chain Pcs. (6), Trash Piles* (1), Wire Pieces (1)	N/A	7-2
Tin Can (2), Tent Stake (10), Railroad Spike (4), Trash Piles* (3), Wire Pieces (1), Misc. Metal** (1)	N/A	7-3
Tin Can (5), Tent Stake (12), Railroad Spike (8), Iron Bolt (1), Cable and Chain Pcs. (17), Trash Piles* (1), Wire Pieces (8), Nail (4), Misc. Metal** (4)	N/A	7-4
Tin Can (4), Tent Stake (11), Railroad Spike (10),	N/A	7-5
Trash Piles* (several)	N/A	7

* Trash piles contained steel items such as saw blades, chains, spikes, horseshoes, and coathangers.

** Misc. Metals include iron slabs, plates, scrap chunks, hitches, hooks, and razor blades.

2.4. Need for the Project

Upon completion of the feasibility study in 1991, an attempt was made to estimate the extent of ordnance contamination. Based upon historical records from the Department of Defense, interviews with local residents and professional personnel associated with the area, and site investigations, it was clear that the extent and location of ordnance was poorly defined. Targets were unknown and ordnance was found over a fairly large and dispersed area.

Records indicate that 81 mm, 105 mm, and 155 mm artillery shells were fired during training exercises during World War II. In 1991, additional ordnance was found including 57 mm armor piercing, 80 mm high explosive, and 81 mm white phosphorus rounds. It is anticipated that additional ordnance of these types are located in the area.

From the search of 281 acres in 1991, 13 pieces of unexploded ordnance were found (10.5 acres of this was a subsurface search with 6 pieces of ordnance found below the surface). The ordnance removal project calls for a search of trails and campsites, i.e., 105 acres. An extrapolation cannot be made with great accuracy. However, if the same concentration of ordnance is found, the search may lead to between 5 and 30 pieces. The ordnance may include both live rounds and practice rounds. It is not possible to estimate the distribution.

The location of the ordnance may be widely dispersed. Original targets are unknown. Novice operators of gun emplacements most likely would have had poor accuracy in hitting targets, even if they were known. Rains and floods, the most recent in 1993, have caused changes in stream channels. As a result, old ordnance previously buried, has surfaced. Also, there is evidence, such as a shell found lodged in the crotch of a tree, that flood waters may have carried ordnance to new locations.

If casings of the ordnance are intact, it is anticipated that no degradation of the explosive charges have occurred. This has been the case in most ordnance found to date. The explosive potential is adequate to maim or kill. The Department of Defense has determined that, due to public use of the wilderness area, it is unacceptable to risk allowing heavily used areas to remain as potentially contaminated sites.

2.5. Statement of Authorization

This project is authorized as part of the Defense Environmental Restoration Program (DERP) as described in Section 160, Environmental Restoration of Comprehensive Environmental Response Compensation and Liability Act (CERCLA). One of the goals of this program is the "correction of other environmental damage (such as detection and disposal of unexploded ordnance) which creates an imminent and substantial endangerment to the public health or to the environment." The U.S. Army Corps of Engineers was designated as the executive agent for the Department of Defense in implementing the program. The program is administered by the Ordnance and Technical Program Division of the U.S. Army Corps of Engineers, Huntsville Division, Huntsville, Alabama. The environmental assessment is administered by the Huntington District, Huntington, West Virginia.

2.6. Brief Summary of the Area

2.6.1. Site Location and Description

The Dolly Sods Wilderness is a 10,215-acre site in the Monongahela National Forest and lies within Grant, Tucker and Randolph counties, West Virginia. The Dolly Sods Wilderness lies adjacent to the Dolly Sods Scenic Area. In other words, a portion of the area known as Dolly Sods is a wilderness area. The ordnance removal project is confined to the wilderness area. The location of Dolly Sods Wilderness is shown in Figure 2-2.

The wilderness area, managed by the USDA Forest Service as part of the Monongahela National Forest, remains in a natural, undisturbed condition and is open to the public. The Forest Service maintains 20.8 miles of trails. An estimated 45,000 to 75,000 people come to the Dolly Sods Wilderness each year for hiking, camping, picnics, and hunting.

The Dolly Sods Wilderness varies in elevation from 3,200 to 4,100 feet above sea level. In general, the terrain is quite rocky and rugged and the plant and animal life is comparable to that of northern Canada. Several notable topographic features include the Red Creek and its tributary runs, Breathed Mountain and other knobs, and the "sods" (open grassy areas) or bogs (poorly drained areas covered with sedges or other water-loving plants) in the level parts of the wilderness area.

Red Creek runs from the northern boundary to the southwest corner of the Dolly Sods Wilderness dividing the wilderness area roughly in half. Its tributaries include Stonecoal Run to the west and Fisher Spring Run to the east. Stonecoal Run is the longest tributary of Red Creek in the Dolly Sods Wilderness. It runs from the northwest corner of the wilderness area to its confluence with Red Creek, just south of Breathed Mountain, in the south-central part of Dolly Sods. Little Stonecoal Run runs roughly parallel to the larger Stonecoal Run and is approximately 1 mile west of it. Fisher Spring Run runs from the bogs in the northeast corner of the wilderness area, southwest to the north-central part of the wilderness where it meets Red Creek. Close to the northern edge of Dolly Sods Wilderness, the Left Fork of Red Creek branches off from the main stream.

Breathed Mountain is in the south-central area of the Dolly Sods Wilderness and separates Red Creek from Stonecoal Run. It rises to over 3,800 feet and drops steeply to Red Creek and Stonecoal Run. Blackbird Knob is about 1/2 mile north of the Dolly Sods Wilderness, north of the confluence of Red Creek and the Left Fork. Bell Knob is roughly 1/4 mile to the east of the wilderness area, in the Dolly Sods Scenic Area. A lookout tower is located at the top of Bell Knob. Cabin Mountain is located just beyond the northwest corner of the Dolly Sods Wilderness.

The sods, or bogs, are located mostly in the northern part of the wilderness area and can be found primarily at the headwaters of the runs and streams in the area. Large areas of sods are located in the level areas at the head of the Fisher Spring Run and an unnamed tributary of the Red Creek. These sods are marshy and contain different types of vegetation than are found in the surrounding forest.

There are no roads in the wilderness area. Forest Service Road 75 is located on the eastern edge and Forest Service Road 19 is located on the southern edge of the site. They are 1 1/2-lane gravel roads which run along the boundaries of the wilderness area. Several trail heads located along the roads establish starting points for the hiking trails leading into the wilderness area.

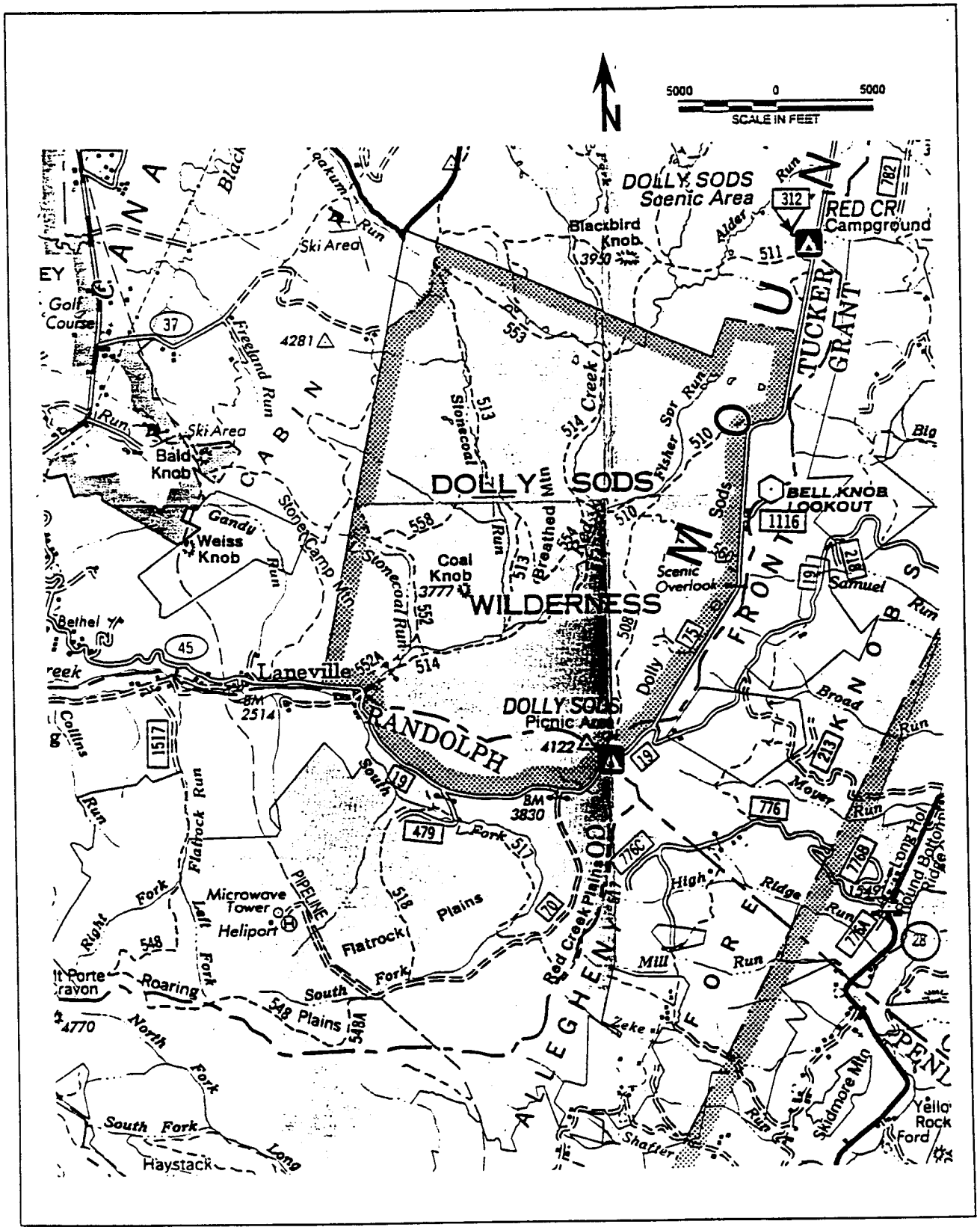


Figure 2-2. General location of the Dolly Sods Wilderness.

Dolly Sods is bordered by Monongahela National Forest land to the east and south and private land to the north and west. Dolly Sods North is north of the Dolly Sods Wilderness; it is owned by the Forest Service. In addition, Forest Service managed land includes the Flatrock Plains to the south and the Foreknobs of the Allegheny Front to the east and northeast. The Foreknobs extend a few miles down towards Jordan Run, a tributary of the North Fork of the South Branch of the Potomac River. Forest Service Road 75 extends north along the Dolly Sods Scenic Area to Bear Rocks where it turns east and winds down to West Virginia Route 4, also known as Jordan Run Road. In addition, the roads along the Dolly Sods boundaries can be reached by Forest Service Road 19 which runs from the southeast corner of the Dolly Sods Wilderness until it meets Jordan Run Road at a point less than a mile from West Virginia Route 28.

To the north of Dolly Sods are Blackbird Knob and the two forks of Red Creek. This land was recently purchased by the Forest Service from the Western Maryland Railroad. At the southwest corner of Dolly Sods is Laneville where Forest Service Road 19 ends and West Virginia Route 45 extends to the west. To the west is Cabin Mountain and, then, Canaan Valley. Canaan Valley contains the Canaan Valley State Park, the Canaan Valley National Wildlife Refuge, as well as numerous farms and two ski resorts.

The vegetation in the Dolly Sods Wilderness is similar to that of northern Canada. Typical plant communities in the Dolly Sods area, as described in the Dolly Sods information pamphlet, include "one-sided" red spruce, sphagnum bogs, yellow birch, heath barrens, and patches of aspen. Much of the plateau is covered with heath barrens where predominant plant species include azaleas, mountain laurel, rhododendron, and blueberries. The plants in the bogs include cranberries and the carnivorous sundew plant which grows on mats of sphagnum moss. In the lower lying areas, hardwoods such as birch, aspen, and maple can be found and plantations of red pine exist throughout the Dolly Sods area.

Animal life within the Dolly Sods Wilderness is diverse. Common species found in the area include the spring peeper, wood frog, redback salamander, slimy salamander, mountain dusky salamander, smooth green snake, ringneck snake, whitetailed deer, red squirrel, chipmunk, and several other small mammals, and a variety of birds. Less common species include the Cheat Mountain salamander, timber rattlesnake, snowshoe hare, and black bear. Endangered and threatened species found at the Dolly Sods Wilderness include the Virginia northern flying squirrel and the Cheat Mountain salamander.

The Dolly Sods Wilderness is managed so as to remain undeveloped. The purpose of the area is to preserve part of our lands in a state untrammelled by man. There are several primitive hiking trails through the wilderness, and camping is allowed with restrictions upon activities which might damage the wilderness area. A picnic area has been created next to Forest Service Road 75 at the southern end of the wilderness area, and hunting is allowed during the West Virginia hunting season.

2.6.2. Site History

Before logging activity occurred in the late 1800s, the plains in the Dolly Sods area were covered by a red spruce and hemlock forest. The majority of logging occurred between 1890 and 1910. After these trees were logged, the humus layer was destroyed by fires leaving the current, relatively infertile, rocky terrain.

Local farmers burned the plains to create grazing lands called "sods" and grazing continued until about 1980. One of the first inhabitants of the area was the pioneer Dahle family. This family surname was altered to become the "Dolly" of Dolly Sods.

The USDA Forest Service bought the land which is now the Dolly Sods Wilderness as logging came to an end between 1910 and 1913. In the 1930s, the Civilian Conservation Corps planted red pine and other conifers and assisted in the construction of Forest Service Road 75. Military maneuvering and training were performed in the Dolly Sods area during World War II from 1943 to 1944 and the land was returned to the Forest Service in 1950. The Dolly Sods Wilderness was created by an act of Congress in 1975.

During World War II, about 2,181,000 acres in the vicinity of Dolly Sods were used by the Thirteenth Army Corps of the Third Army for mountain training and maneuvers including the firing of artillery and mortars. This training continued from October 15, 1943, to July 1, 1944, with several divisions taking part in training. These divisions included the 77th Infantry from October 15, 1943 to January 2, 1944; the 28th Infantry from August 2, 1943 to September 30, 1943; the 31st Infantry from February 4, 1944 to March 28, 1944; and the 95th Infantry from May 1, 1944 to July 1, 1944.

Records on the military operations in the area are scarce because the majority of pertinent documents have been lost or destroyed over time, but it is known that the targets of the 105 mm and 155 mm artillery fire near the Dolly Sods Wilderness included the southern face of Blackbird Knob and the eastern face of Cabin Mountain. There were, apparently, three groups of gun emplacements. One was in Canaan Valley, although the exact location of these guns is not known. A second was along Forest Service Road 75 from "a point near the Bell Knob tower, north to the end of the road." Finally, there were gun emplacements "on the east side of the mountain on the Allegheny Front . . . north of the Dolly Sods Wilderness Area." The gun emplacements to the west (the Canaan Valley) would have fired only upon Blackbird Knob while the positions to the east apparently fired at both Blackbird Knob and Cabin Mountain. The firing locations and targets are shown in Figure 2-3. One can see that some of the artillery fire would have been fired across the northern end of the wilderness area.

In addition to this artillery fire, mortar fire took place in the area. The targets are unrecorded, however, it is possible that open, high ground would have been targeted to lessen the likelihood of fires started by the explosions and to make impacts more visible. The mortars were probably fired from a multitude of locations around the Dolly Sods area.

It is known that the artillery range was grid-searched and decontaminated of unexploded ordnance following the end of operations in the area. At some later time, as persons hiking into the area continued to discover isolated ordnance, military Explosive Ordnance Disposal (EOD) teams were used again to clear the area of unexploded ordnance. The exact location and extent of these disposal operations are unknown. Records have not been maintained.

Ordnance has been discovered incidently several times in the recent past. According to Forest Service personnel, three of these mortar rounds were in the Dolly Sods Wilderness itself and four were found further to the north, in the Blackbird Knob area. Four pieces of ordnance were found in 1994, the most recent during bear hunting season. All of the recently discovered ordnance consists of 81 mm mortar shells, however, it appears that 105 mm artillery ordnance has been found in the vicinity of Dolly Sods in the past. Information brochures and bulletin boards in the wilderness and adjacent areas provide information describing the ordnance and warning the public not to touch or move mortar or artillery shells found in the wilderness.

In 1991 the U.S. Army Corps of Engineers conducted a feasibility study to determine the extent of contamination. Samplings of areas considered most likely to have been used as targets or to contain overshots or undershots were searched. Approximately 281 acres of the 10,215 acres of the Dolly Sods Wilderness were searched with hand-held magnetometers. A surface sweep (within 6 inches of the surface) was conducted on 281 acres and seven pieces of ordnance were found. A subsurface sweep (deeper than 6 inches below the surface) was conducted and six pieces of ordnance were unearthed. A total of 13 pieces of ordnance, ranging in size, were found. One piece was found close to a site used as a campfire pit. The ordnance was exploded in place or moved a short distance, then exploded.

2.7. Jurisdiction

The Dolly Sods Wilderness is part of the Monongahela National Forest. It is managed by the USDA Forest Service. The Dolly Sods Wilderness lies within the Potomac District. The Potomac District Ranger is Nancy Feakes.

The U.S. Army Corps of Engineers has been designated by the Department of Defense as the agency responsible for ordnance removal at sites throughout the United States, including the Dolly Sods Wilderness. The program is administered by the Ordnance and Technical Program Division, Huntsville, Alabama. The Corps of Engineers, Huntington West Virginia District, has managed completion of the Environmental Assessment. A. Benjamin Borda, Jr., is the Chief, Environmental Resources Branch.

All work performed at the Dolly Sods Wilderness has been, and will be reviewed and approved by the USDA Forest Service, Monongahela National Forest.

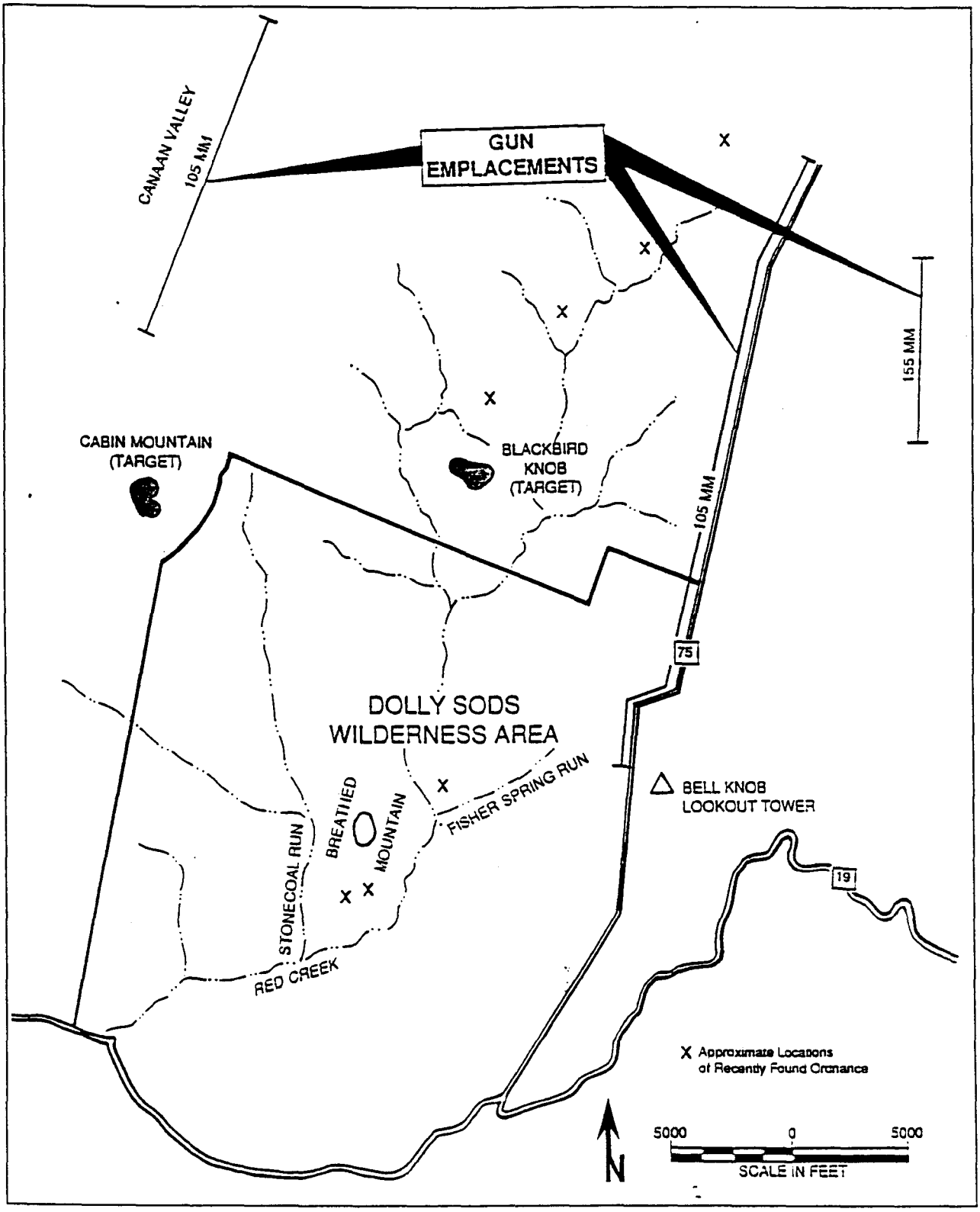


Figure 2-3. Firing locations and general target areas at Dolly Sods. Ordnance has been located throughout the area.

3.0. COORDINATION WITH THE PUBLIC AND RESOURCE AGENCIES

3.1. Public Involvement Process

The Dolly Sods Wilderness Ordnance Removal Project Environmental Assessment has involved considerable communication and coordination with jurisdictions, government agencies, citizens' groups and interested parties. Communication with agencies and the community has been maintained through a series of public involvement meetings and numerous individual meetings and briefings. The intention of the public involvement program was to develop a process by which all affected agencies and citizens could become involved in the project in its early stage. The goal of this program was to identify concerns related to environmental impacts in the beginning and integrate those concerns into the Environmental Assessment process. The following public involvement objectives were developed prior to the project initiation:

- To establish and maintain the credibility of the overall assessment and response effort, including the need to address concerns regarding safety and environmental restoration;

- To inform and educate the public as to how the ordnance removal activities could be undertaken, possible impacts on the environment, and how any potential problems might be mitigated;

- To accurately identify and consider the values and concerns of the public, government agencies and nearby land owners; and,

- To integrate public views and agency policy with technical data into the overall mitigation approach.

3.2. Agency Coordination

The Dolly Sods Wilderness is part of the Monongahela National Forest. It is managed by the USDA Forest Service. Since the inception of the project in 1991, the U.S. Army Corps of Engineers has closely coordinated all activities with responsible Forest Service officials.

Following the development of the *Feasibility Study Dolly Sods Wilderness Area: Final Work Plan for Surface and Subsurface Investigation and On-Site Disposal of Ordnance* in 1991 and the completion of the *Feasibility Study Dolly Sods Wilderness Area: Engineering Report for Extent of OEW Contamination and Evaluation of Remedial Action Alternatives* in 1992, Forest Service input was solicited. It was provided in a meeting held on April 3, 1995. Based upon Forest Service input, the scope of the project was modified, i.e., from demolition of ordnance located throughout the wilderness area, to demolition of that ordnance located on trails and in campsites. This change reflects the Forest Service's wilderness management practices and objectives. Clearance of ordnance from the entire Dolly Sods Wilderness would have been

an immense task, requiring years to complete. The ground cover at Dolly Sods contains iron-bearing rock. Therefore, ordnance detection could not be accomplished by aerial surveys and required surveys with hand-held magnetometers. Due to dense brush and tree cover, large tracts would have to be cut and cleared to allow UXO technicians to survey for ordnance. This aggressive action was deemed incompatible with wilderness management practices.

Discussions with other key agencies were held in the beginning of the Environmental Assessment activity. The goal was to discuss the project plan in detail, to solicit technical advice, and to identify and consider concerns for subsequent inclusion in the Environmental Assessment process. A log of meetings is included in Appendix I. Agencies consulted included:

- West Virginia Department of Environmental Protection, Office of Water Quality;
- West Virginia Department of Environmental Protection, Office of Air Quality;
- West Virginia Department of Environmental Protection Office of Environmental Protection;
- West Virginia Division of Natural Resources;
- United States Fish and Wildlife Service; and
- United States Department of Agriculture Forest Service.

During the initial meeting with the United States Fish and Wildlife Service, concerns related to impact of the project on endangered species led the Fish and Wildlife Service biologist to request a Biological Assessment. That study was completed by a nationally recognized expert under contract to the Corps and it was integrated with the Environmental Assessment process. The Biological Assessment is included within the Environmental Assessment in Appendix IV.

Close contact was maintained with the resource agencies during the development of the Environmental Assessment. Draft text was provided to confirm that technical concerns were addressed.

The Draft Environmental Assessment was forwarded for comment to agencies including: the West Virginia Department of Environmental Protection, the West Virginia Division of Natural Resources, the United States Fish and Wildlife Service, and the United States Department of Agriculture Forest Service. Comments were received from the United States Fish and Wildlife Service and the West Virginia Division of Natural Resources; they are included in Appendix II. In its review of the mitigation measures documented within the Draft Environmental Assessment, the United States Fish and Wildlife Service determined that ". . . the proposed project is not likely to adversely affect" endangered, threatened, and sensitive species. The West Virginia Division of Natural Resources offered comments and suggestions primarily related to the mitigation of impacts on hunters.

3.3. Public Information

The object of the public information program has been to identify the affected communities and to understand and integrate their concerns into the technical aspects of the study. A public notice was issued April 7, 1995, to describe the project and solicit input. Subsequently, a workshop was held on May 24, 1995 in Morgantown, WV. The meeting was announced through telephone notification to parties that had expressed interest. A detailed description of the Environmental Assessment process was given, as well as more detailed technical information regarding the project plan, potential environmental impacts, and mitigation techniques. Specific attempts were made to invite the public and involve them early on in the Environmental Assessment process. Meetings were held with representatives of concerned groups including:

- West Virginia Sierra Club; and
- West Virginia Citizens Action Group.

Following the release of the Draft Environmental Assessment, a presentation was requested by interested citizens in the Huntington, West Virginia, area. On August 16, 1995, an overview of the proposed project was given. The open meeting was announced by Huntington newspapers.

Issues of concern raised by the public were discussed in meetings and dialogue with individuals. Also, those issues have been addressed in this Environmental Assessment. Summaries of some of the most commonly heard concerns are included in Table 3-1. All of the concerns are addressed within this Environmental Assessment.

The public involvement program was designed to be an ongoing process. Environmental Assessment consultant New-Bold Enterprises made itself available throughout the Environmental Assessment process to give special presentations as well as information over the phone.

3.4. Public Information Repositories

Information repositories for the Draft Environmental Assessment were established at public libraries in Elkins, Parsons, Petersburg, and Morgantown, WV and with West Virginia University extension offices in Tucker, Randolph and Grant counties. This provided the public with a means to review and comment on the draft Environmental Assessment. A notice of public review of the draft Environmental Assessment was printed in local newspapers (Cumberland, MD; Charleston, Morgantown, Elkins, Parsons, and Petersburg, WV) announcing the date and locations the document would be available.

An information repository was also established at the U.S. Army Corps of Engineers Huntington District Office. All supporting documentation not available in public libraries has

been retained for public review. Included is the *Feasibility Study Dolly Sods Wilderness Area: Engineering Report for Extent of OEW Contamination and Evaluation of Remedial Action Alternatives*, *Feasibility Study Dolly Sods Wilderness Area: Final Work Plan for Surface and Subsurface Investigation and On-Site Disposal of Ordnance*, and minutes of meetings.

3.5. Project Mailing List

Since this was the first time any formal communications regarding the Environmental Assessment were sent out to interested parties, a mailing list was developed. This mailing list included names from federal, state and local agencies, nearby businesses, elected officials, media, residents and interested parties. The U.S. Army Corps of Engineers has continued to expand the mailing list by soliciting names from individuals who have performed research at the Dolly Sods Wilderness, and by adding names recommended by the public.

3.6. Public Comments

Nine letters were received from the public in response to the April 7, 1995 public notice. A formal record of responses was kept and is included in tabular form in Appendix I.

Three letters were received from the public with comments related to the Draft Environmental Assessment. A formal record of responses was kept and is included in tabular form in Appendix I. Three citizens suggested that the No Action Alternative was preferable; one offered suggestions related to demolition procedures.

Table 3-1
Concerns Raised by the Public and by Cooperating Agencies Regarding Practicable Means to Avoid or Minimize Harm to the Environment

Issue of Concern	Effect	Mitigation Plan
Remediation will occur in habitat of endangered and threatened species.	Portions of Dolly Sods are in the habitat of the Cheat Mountain salamander. Detonation of ordnance could lead to incidental taking.	Prior to excavation and detonation perform nocturnal survey, move salamanders. As part of remediation, return habitat to previous condition, including replacement of original topsoil and leaf litter. Return salamander.
Remediation will cause disturbance of 105 acres, which may contain many sensitive and rare botanical species.	Could lead to disturbance of plants, however, walk-through by UXO technicians will have the same impact as use by hikers. Plants will not be disturbed.	UXO crews will follow procedures developed for the 1991 feasibility study. These procedures caused no disturbance. Restoration will include restoration of ground cover and reseeding as appropriate.
Many of the trails are on wet soils and on steep slopes. UXO teams may cause damage to area when surveying.	Could lead to erosion if plants are damaged on steep slopes. Could cause visual/ aesthetic damage, comparable to that caused by hikers.	If possible, crews will avoid steep and slippery slopes, for personal safety as well as for environmental protection. If damage occurs, the on-site Forest Service representative will determine if erosion techniques need to be employed. If so, reseeding and placement of sediment controls will prevent erosion.
Big and deep craters could be created throughout the Dolly Sods Wilderness creating visual and environmental disturbances.	The amount of ordnance is not known, but based on the 1991 study at the Dolly Sods Wilderness, between 5 and 30 pieces of ordnance may be found. Craters created by the 1991 detonations were small and shallow due to the rocky nature of the ground; they were not visible in 1995.	A Forest Service employee will be on-site with UXO contractors. If a crater is formed by detonation of ordnance, remediation requirements will be determined by the Forest Service. Remediation techniques will be a function of size and location of the crater, and may include filling with native soil and reseeding.
Noise from the project could disturb migrating birds, as well as the solitude of the wilderness.	It is estimated that between 5 and 30 pieces of ordnance may be detonated over a 6-month period. Noise produced will be comparable to cracks of gun shots.	Noise will be dampened with sandbag cover.

Table 3-1
Concerns Raised by the Public and by Cooperating Agencies Regarding Practicable Means to Avoid or Minimize Harm to the Environment (Continued)

Issue of Concern	Effect	Mitigation Plan
People will travel long distances to camp and hike at the Dolly Sods Wilderness and areas will be closed.	Isolated portions of trails and campsites will be closed throughout the 6 months. The majority of the Dolly Sods Wilderness will remain open to users.	Efforts will be made to limit the number of trails closed at a time. Work plans will be coordinated with the Forest Service. UXO crews will not work on weekends or holidays which are the heaviest use periods. Signs suggesting alternate use areas will be posted.
Risk to hunters continues to be high unless the entire wilderness area is searched and cleared.	The proposed project will not remove all danger posed by ordnance. However, most heavily-used access areas will be safe.	Education through caution signs and literature will alert hunters to recognize the ordnance.
Stream beds may be damaged by detonation of ordnance.	Ordnance will not be detonated in stream beds.	Ordnance will be relocated prior to detonation.

4.0. ALTERNATIVES INCLUDING PROPOSED ACTION

In this section of the Environmental Assessment, all alternatives are addressed so that reviewers may evaluate their comparative merits. A very detailed description of the proposed action is included later in this section. Alternatives currently considered include:

- Alternative 1—Searching 20 feet on each side of Forest Service designated hiking trails, and detonating ordnance in place. Searching Forest Service inventoried campsites and detonating ordnance in place. These two strategies will affect 105 acres. This is the selected alternative.

- Alternative 2—Searching 20 feet on each side of Forest Service designated hiking trails and detonating ordnance in place (103.8 acres). No search of campsites.

- Alternative 3—No Action—no search for ordnance. Disposal of ordnance found and reported by users of Dolly Sods.

Other alternatives which have been considered in the very early stages of the project, such as searching and clearing the entire wilderness area, have been deemed too aggressive by the Forest Service. The three alternatives under current consideration are those which are considered by the managers of the wilderness, i.e., the Forest Service, to be appropriate for the area.

4.1. Discussion and Evaluation of All Reasonable Alternatives

4.1.1. Discussion of Discarded Alternatives

Following the feasibility study conducted by the U.S. Army Corps of Engineers in 1991, an *Engineering Report for Extent of OEW Contamination and Evaluation of Remedial Action Alternatives* was developed on January 21, 1992. Metcalf & Eddy, Inc., authored the report under contract to the U.S. Army Corps of Engineers, Huntsville Division.

In the engineering report of the feasibility study, four alternatives for ordnance removal were presented and discussed in detail. Three of these alternatives, while effective plans to locate and remove ordnance, have since been deemed incompatible with the wilderness designation of Dolly Sods. A summary of discarded alternatives is presented in Table 4-1.

Table 4-1
Discarded Alternatives

Alternative	Description	Areas to be Remediated
Level One Remediation	Remediate ordnance from areas that are accessible to the public which can be remediated without brush clearing, and which are likely to contain ordnance.	250 acres on and around trails in Breathed Mountain in the Red Creek valley.
Level Two Remediation	Remediate areas where ordnance is thought to exist, investigate areas where ordnance might exist, and remediate areas where ordnance is found to exist. Brush clearing of 320 acres would be necessary.	915.5 acres including larger areas around Breathed Mountain, Red Creek valley, and other areas.
Level Three Remediation	Remediate a larger portion of Dolly Sods with the intent of removing almost all of the ordnance from the wilderness area. Investigate areas where ordnance might be found and remove it if found. Brush clearing of 449 acres would be necessary.	1,281.5 acres including larger areas around Breathed Mountain and Red Creek valley.
No Action	No remedial activities would take place.	N/A

4.1.2. Discussion of Currently Considered Alternatives

Alternatives currently considered are presented in Table 4-2.

Alternative 1: Remediate Hiking Trails and Campsites (105 acres)

Surface and subsurface areas along hiking trails and in campsites will be searched and remediated. A swath of 20 feet to either side of trails will be searched. If metal is detected and is not visible on the surface, the area will be excavated by hand to a depth of 1 foot. If no ordnance is encountered, the hole will be filled and tamped. The same procedure will be implemented in campsites with the exception that sites will be excavated up to 4 feet. This may not be possible in many campsite areas due to the limited top soil and rocky nature of the area. However, when possible, up to 4 feet will be excavated. This is because activities in campsites often involve penetrating the surface to greater depths. Such activities include burying waste and building fire pits.

A highly detailed explanation of the surface and subsurface investigation plan is presented in the *Feasibility Study Dolly Sods Wilderness Area: Final Work Plan for Surface and Sub-*

Table 4-2
Three Alternatives Currently Considered for Remediation at Dolly Sods Wilderness

Alternative	Description	Areas to be Remediated
#1—Remediate Hiking Trails and Campsites	Search and remediate areas 20 feet to either side of Forest Service-designated hiking trails and in Forest Service-inventoried campsites. Detonate ordnance in place. No brush cutting except to access ordnance.	103.8 acres of trails and 1.5 acres of campsites.
#2—Remediate Hiking Trails	Search and remediate areas 20 feet to either side of Forest Service-designated hiking trails. Detonate ordnance in place. No brush cutting except to access ordnance.	103.8 acres
#3—No Action	No remedial activities would take place.	N/A

surface Investigation and On-Site Disposal of Ordnance, prepared in July of 1991 by Metcalf & Eddy, Inc., for the U.S. Army Corps of Engineers, Huntsville Division. The following discussion contains excerpts of the information presented in that document. To allow for convenience for reviewers of the Environmental Assessment, a more detailed explanation of the plan is presented here than would normally be found in an assessment document.

Ordnance will be removed by a UXO team under contract to the Corps of Engineers. All work will be coordinated with the Forest Service through an on-site representative of the Forest Service and the U.S. Army Corps of Engineers. A flow-chart illustrating the work plan is presented as Figure 4-1.

A work plan and schedule will be developed for use by the UXO team. The work plan will incorporate plans and procedures for mitigation specified within the Environmental Assessment. The plan will be site-specific, and may vary slightly from that presented in this section. For example, if alternate equipment is appropriate, it may be substituted. The work plan will be reviewed with the Forest Service Potomac District Ranger or her designee. Areas of concern, be they locations close to streams, areas of known habitation of botanical and zoological species of concern, areas of steep slopes likely to erode, etc., will be discussed in detail and visited as necessary. That way, potential problems will be discussed prior to work in the field. A Forest Service employee will be in the field daily to provide oversight and technical assistance.

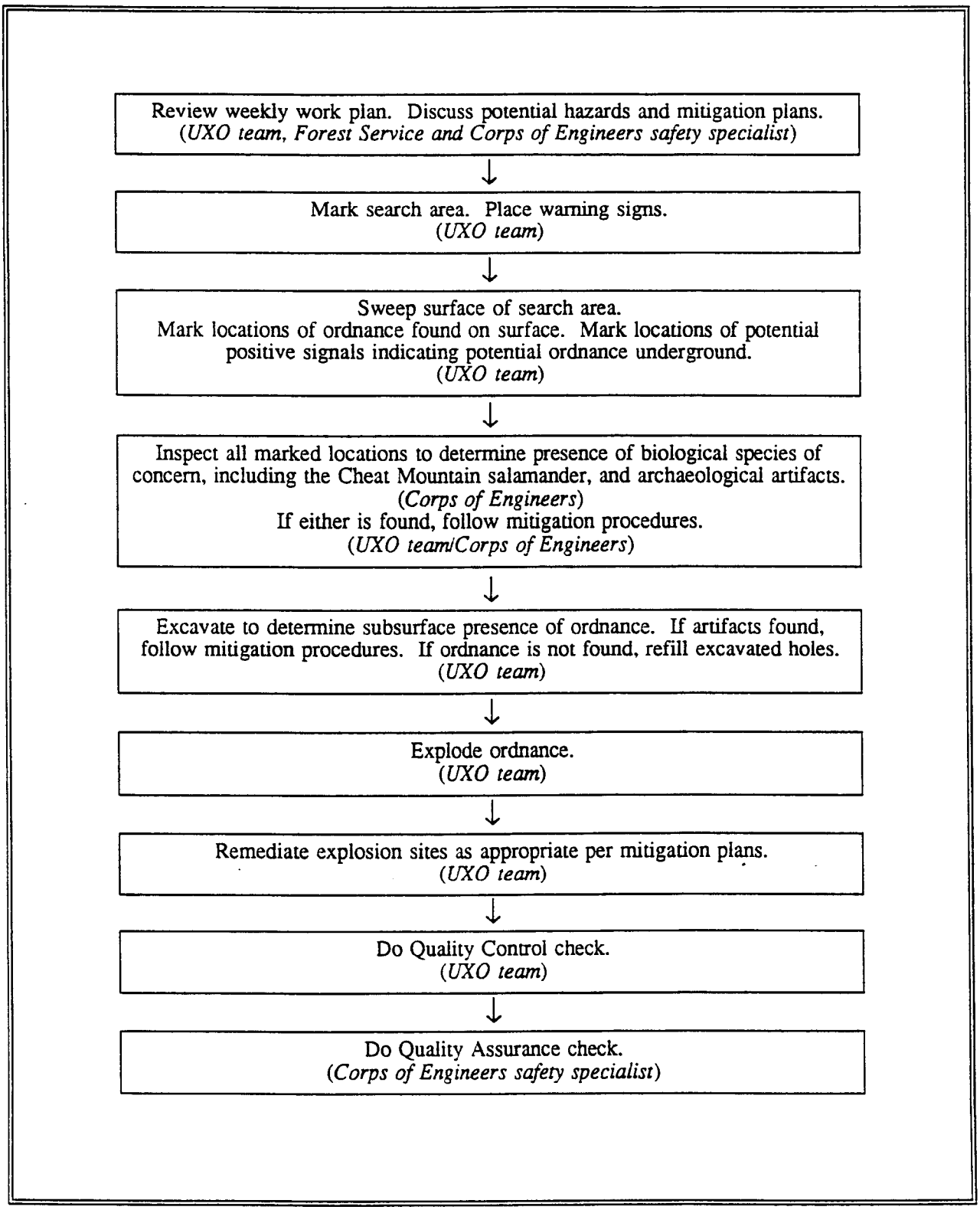


Figure 4-1. Weekly Ordnance Detection and Removal Work Plan Flow Sheet

Surface and subsurface areas along hiking trails will be searched by the UXO team. The Schonstedt Magnetic Locator will be used in conjunction with visual techniques to assist in searching those areas where vegetation reduces visibility. That way, brush clearing is not necessary. Areas of heavy brush will not be cleared.

Geophysical investigation including magnetometry and metal detection is appropriate for locating ferrous objects such as individual projectiles where these objects are buried and cannot be found using a visual search. In addition to the visual and geophysical investigation, the UXO team will hand excavate shallow contacts, 1 foot or less in depth on and along trails and up to 4 feet in campsites.

For the Dolly Sods project, a Global Positioning System (GPS) will be used to solve the difficult problem of determining the UXO team's position in the densely wooded areas of the wilderness. GPS will be used in the planned project to accurately locate areas to be searched. In addition, GPS may be used to accurately map any ordnance which is found. Locations will be plotted on new digitized topographic mapping that has been created by the Corps of Engineers from 1995 aerial photos.

Two different metal detectors may be used in searching for ordnance at Dolly Sods. Each has distinct functions. For both, instruments will be calibrated to the greatest degree possible to differentiate between small metal fragments and ordnance. This effort will minimize digging holes to find metal fragments instead of ordnance. Equipment includes:

- Schonstedt Magnetic Locator. This is a hand-carried, dual sensor magnetic locator. It responds to the difference in magnetic field strength between two sensors mounted approximately 20 inches apart in the probe.

- Foerester Ferex Electromagnetic Detector. The Foerester Ferex Ordnance Locator, designated the MK 26 Ordnance Locator, is in use by the U.S. Military forces for detecting subsurface ordnance items. The locator is a hand-held unit and uses two fluxgate magnetometers, aligned and mounted a fixed distance apart to detect changes in the earth's ambient magnetic field caused by ferrous metal or disturbances caused by soil conditions. Both an audio and a metered signal are provided to the operator. This instrument shall be used during both the Quality Control checks (UXO team) and the Quality Assurance checks (Corps of Engineers safety specialist).

The UXO team will use site-specific, technical survey methods. The basic methods of sampling an area will be utilized to determine the amount of unexploded ordnance (UXO) or OEW contamination present:

- Visual Survey—Entails visually scanning the area being searched to locate ordnance on the surface or surface indication of the presence of subsurface ordnance (e.g., craters or burial trenches).

Figure 4-2. Sweep team performing the surface search in the 1991 feasibility study. The same techniques will be followed in the proposed project.

- Geophysical Survey—Using magnetometers and metal detectors to examine the surface and subsurface area in a non-intrusive manner.

- Hand Excavation—Using hand excavation tools to excavate metallic contacts located.

All of the survey methods will be used to conduct the investigation.

Surface Survey: The Schonstedt Magnetic Locator may be utilized during all visual survey operations to aid in the location of ordnance obscured by vegetation and other ground cover. All contacts located will be uncovered down to ground level. If the item is visible at ground level it will be plotted and identified. If the item is below ground level it will be marked and plotted on the site map and excavated later.

Sweep Procedures: The sweep team will form a line along one side of the area spaced at approximately 5-foot intervals. This will result in each individual being responsible for a lane approximately 5 feet wide. The sweep line will proceed across the area until the entire area has been surveyed.

Communications and Control: The sweep team will maintain communications via two-way radio with the Command Post (CP) at all times. If communications with the CP are lost, the sweep team will suspend all activities until communications are restored.

The UXO supervisor will be responsible for control of the sweep team. This responsibility will include, but is not limited to, the following: ensure that all personnel on the sweep team are aware of the type of ordnance items which may be found and any specific safety considerations which apply to that ordnance; ensure that sweep personnel maintain proper intervals and stay on line during sweep operations; ensure that the entire sweep area is surveyed; ensure that sweep personnel comply with all safety rules applicable to surface survey operations; and ensure that all ordnance items discovered during surface surveys are properly logged, identified, and marked. The UXO supervisor is also responsible for making all decisions pertaining to the safe handling of UXO.

Subsurface Survey

The UXO contractor will use the Schonstedt Magnetic Locator for all subsurface geophysical surveys.

Clearance Procedures

The following clearance procedures will be implemented:

- **Establish the Command Post:** A (CP) will be established. The purpose of the CP is to allow a responsible person, who is familiar with on-site operations, to be present and to take appropriate action in case of an emergency at the work site.

- **Instrument Calibration:** Instruments will be calibrated to differentiate between ordnance and other materials as much as is possible. Prior to use, each locator shall be tested on a buried inert item. If a detector fails to locate this item, it shall be recalibrated, repaired, or replaced.

- **Locate Anomalies:** The subsurface team will consist of one UXO supervisor and one UXO technician, who will carry the Schonstedt Magnetic Locator. The team will search the predetermined area and the team leader will record all positive contacts. All contacts, visual observations, and notations will be made by the team leader and will include location, depth, and type (i.e., scrap or UXO) of contact. All positive contacts will also be marked with a marking flag to facilitate relocating the contact for excavation and identification.

- **Quality Control and Quality Assurance Procedures:** The UXO contractor shall conduct a minimum of 10% Quality Control of all areas searched using the MK 26 Ordnance Locator. The on-site Corps of Engineers safety specialist shall conduct a minimum of 10% Quality Assurance of all areas searched using the MK 26 Ordnance Locator.

- **Hand Excavation:** All contacts located during the subsurface survey will be carefully excavated, using hand tools, i.e., shovels, trowels, etc., to determine identification. The maximum depth for hand excavations shall not exceed 1 foot along trails and 4 feet in campsites. It is Corps of Engineers standard practice to excavate to a depth of 4 feet in areas used for recreation. Due to the rocky nature of the trails, excavation will be limited to 1 foot there. If a contact has not been located after reaching the

Figure 4-3. Foerester Ferex Ordnance Locator will be used in subsurface investigations. If metal is detected, UXO technicians will excavate up to 12″ on trails and 48″ in campsites.

maximum depth, it will be recorded as unknown and plotted on the map. Soil and metal fragments, if found, will be returned to the hole, and soil will be hand-tamped. (Many finds will be photographed in place. Metal debris, such as bottle caps and cans from recent activities, will not be photographed. Photos will be forwarded to the USDA Forest Service archaeologists for evaluation.) Field notes will be maintained to document location. In the event of an excavation revealing materials unknown to the UXO team, an archaeologist will be contacted to evaluate the material prior to proceeding with the excavation. This will assure that damage to archaeologically sensitive items will be minimized. The on-site Corps of Engineers safety specialist has the authority to let the UXO team dig deeper if conditions warrant. During excavation, specific procedures will be followed to protect reptiles and amphibians, such as the Cheat Mountain salamander.

Hand Excavation Procedures

The following hand excavation procedures will be implemented:

- Prior to excavation, location will be established by GPS for future reference by researchers.

- Prior to excavation, photos of the site will be taken to add to the database of information about the wilderness. For example, the photos will allow cataloguing of plant species.

- Prior to excavation, leaf-litter and topsoil will be collected and saved for subsequent replacement after excavation. This will protect the habitat of reptiles and amphibians such as the Cheat Mountain salamander.

- Prior to excavation, a field-trained biologist who can recognize potential habitat of the Cheat Mountain salamander and the species will examine the area. The area to be surveyed will include a 40-foot radius from the spot where metal was detected. All field surveys for the species in areas to be disturbed will be conducted at night and within 48 hours of a rainfall. If Cheat Mountain salamanders are found, specimens in the area to be disturbed will be placed in jars (each specimen in a separate jar) and maintained at temperatures of 14° to 15°C until they can be returned to the exact location where they were collected. After the salamanders have been removed, litter and topsoil from the specimen site will be removed, placed in a container, and returned to the exact location with the salamander at the conclusion of work.

- During excavation, if a reptile or amphibian is found, the organism will be placed in a clean jar, then replaced after work is completed in the area.

- When the metallic object is located, it will be carefully uncovered, identified, plotted, and catalogued. A form will be completed that contains information for archaeologists to further evaluate the object in the future (Details are found in Section 6.2.1.6). Photos of the object will be taken.

- If ordnance is not found, the site will be returned to its former condition.

As part of the coordination with the Potomac Ranger District, advance notice of excavations will be given. The excavated site locations and associated data will be part of a daily field log. A copy of the log will be provided to the Potomac Ranger District at the completion of the project.

- **Survey Evaluation:** Upon completion of the survey, all positive contacts will be recorded on a master site map.

Disposal Procedures

The UXO contractor is responsible for disposal of all hazardous UXO and for the explosive venting of all inert filled ordnance. The UXO contractor is also responsible for the collection of all OEW having a dimension greater than 4 square inches and for turning in of all non-hazardous OEW collected to the Defense Property Disposal Office (DPDO), DRMO-Chambersburg, Letterkenny Army Depot, PA.

Demolition Procedures

The Army Corps of Engineers realizes the necessity and importance of keeping the Dolly Sods Wilderness unmarred by human intervention. The UXO contractor will minimize the damage inherent with demolition operations as much as possible. One way this may be accomplished is by tamping demolition shots with sandbags. Using sandbags will also serve to prevent the possibility of forest fires started by the explosions. Special care is required at the Dolly Sods Wilderness when operations are taking place in areas inhabited by threatened or endangered species. When working in the habitat of threatened or endangered species, no ordnance will be detonated without the approval of the Forest Service and the U.S. Army Corps of Engineers.

A demolition permit covering all phases of blasting operations in demolitions projects will be obtained from the West Virginia State Fire Marshal. All UXO destruction and explosive venting will be performed using electric priming. Electric priming affords the demolition team the greatest degree of control of each detonation and provides the highest extent of safety.

The senior UXO supervisor will coordinate with the Potomac Ranger District prior to all demolition operations for dispatching fire fighters in the event of fire. UXO crews will take

initial attack measures for any fire caused by their operations. The Forest Service will dispatch a back-up fire fighting crew within two hours of notification.

Prior to initiating any explosive charge, the senior UXO supervisor will ensure that a careful check is made and that no personnel are located within the danger area. All electric demolition procedures will be conducted in accordance with standard practices.

By-Products of Detonation

According to army munitions experts, rounds should contain the chemicals listed in Table 4-3. The explosives will have degraded into nitrogen by-products if the casings have broken and exposed the contents to water. However, if the casings are still intact, no degradation is anticipated. It is anticipated that no hazardous, toxic or radioactive by-products have been or will be introduced as a result of the ordnance.

Table 4-3
Contents of Ordnance at Dolly Sods

Explosive	Chemical Composition
TNT	2,4,6 Trinitrotoluene, $C_7H_3N_6O_6$
RDX	cyclotrimethylene-trinitramine, $C_6H_6N_6O_6$
Composition B	a mixture of 60% RDX, 39% TNT, and 1% wax
Black Powder	a mixture of KNO_3, C, and S
Phosphorus	Phosphorus

Practice rounds are casings which contain inert material such as sand. There is inadequate data to estimate the number of practice rounds which may be located at Dolly Sods. They are not visually discernible from live rounds.

Another explosive will be used to detonate the ordnance located at Dolly Sods. It may be a mixture of ammonium nitrate and nitromethane. The chemicals are transported separately and mixed at the site. Shaped charges consist of 31 grams of RDX. Plans exist for control of accidental spillage of chemicals.

By-products of the detonation will be very small fragments of steel casings. There will be no chemical by-products. Any fragments large enough to be picked up will be collected by UXO teams following detonation for removal from the Dolly Sods Wilderness.

Alternative 2: Remediate Hiking Trails

The same plans, procedures, and techniques will be followed in remediation of the campsites as discussed in remediation of hiking trails and campsites, with one exception— campsites will not be searched. Instead of 105 acres, 103.8 acres will be searched. For the convenience of the reader, detailed procedures, since they are the same for both alternatives, are not repeated here.

Alternative 3: No Action

This alternative is no action. The Dolly Sods Wilderness would remain as it is today and no clearance would take place. It is not clear whether warning signs would be posted by Forest Service personnel, as is currently the practice, or if the area would be closed to the public. The USDA Office of the Inspector General has recommended that the area be closed to the public. The preference of the Monongahela National Forest superintendent is to continue as is or to add appropriate restrictions.

4.2. Description of Recommended Alternative

The proposed action is Alternative 1: Remediate Hiking Trails and Campsites. The plan of action is discussed in detail in Section 4.1.

Trails will be searched in their entire length and 20 feet to each side by UXO specialists using hand-held ordnance detection devices such as metal detectors. If metal is indicated, the area will be excavated by hand up to a depth of 1 foot, if necessary. Areas used for camping will also be searched and excavated by hand up to a 4-foot depth where metal is indicated. Small undergrowth, grasses, and fallen trees will be cleared only if necessary to search an area and only if the area is accessible to hikers, campers, or hunters. Earth will be excavated only if ferrous metal objects are detected. Discovered UXO with fuses intact will not be moved for safety reasons but will be destroyed in place by detonation.

A detailed, site-specific work plan and schedule will be developed by UXO specialists. The plan will include all mitigation techniques spelled out in the Environmental Assessment. Work will be coordinated with the Forest Service's Potomac District Ranger or her designee. Each week the UXO specialists will discuss upcoming activities with the ranger or her designee so that issues of concern can be addressed. For example, work on steeply sloping terrain or in wetlands may require special practices prescribed by the managers of the wilderness, the Forest Service.

A Forest Service employee will be on-site during all phases of the project to provide oversight, assistance, and technical assistance. Archaeological and biological specialists will be available to address issues related to historical preservation or protection of threatened, endangered, or sensitive species, should they arise during field work. Specific plans have

been developed to mitigate adverse impacts to biological populations and archaeological resources.

The Forest Service employee will be consulted for guidance in the event that remediation of ordnance would be on a steep slope, or close to a stream bed, or will cause the creation of a significant crater. The Forest Service will work in conjunction with the Corps of Engineers/UXO specialists to minimize impacts of the explosions. If necessary, the craters will be filled with soil from a borrow source identified by the Forest Service, however, every effort will be made to preserve soil and surface litter and return it to the area following excavation and/or demolition. This will limit disturbances to zoological populations. The crater may be seeded with native species such as Allegheny flyback or crinkle grass if necessary to prevent erosion.

It is important to note that during the 1991 feasibility study, the UXO specialists, the Forest Service employees, and the Army Corps of Engineers established a good working relationship. There was frequent interaction, both of a technical as well as a logistical nature, which caused the feasibility study to be completed with minimal impact to the Dolly Sods Wilderness. The only issue not handled to the satisfaction of the Forest Service was the treatment of historical artifacts. Findings were not photographed or documented in context. Plans call for careful documentation in the upcoming remediation. Lessons learned from the feasibility study will aid in the completion of the upcoming remediation.

In the 1991 feasibility study, 281 acres were searched. For the proposed action 105 acres will be remediated. It is reasonable to assume that the impact of this action will be significantly less than that of the feasibility study. The Forest Service has not performed a formal analysis of the impact of the feasibility study, however, they observe that impact was very limited and short-term.

4.3. Reasonable Alternatives Not Within the Jurisdiction of the Agency

This project is authorized as part of the Defense Environmental Restoration Program of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). As such, the Department of Defense (DOD) has a goal of correcting environmental damage which creates an imminent and substantial endangerment to public health or welfare or to the environment. Any environmental action required to remediate the Dolly Sods Wilderness would be within the purview of the DOD. There are no reasonable alternatives for remediation which are not within the purview of the DOD.

4.4. Impact of No Action Alternative

No action generally suggests a continuation of the status quo, however, it is not clear whether this is the case for the Dolly Sods Wilderness. The USDA Office of the Inspector General (OIG) has reviewed the situation, and has recommended that the wilderness area be closed

to the public. Jim Page, supervisor of the Monongahela National Forest, has taken issue with the recommendation, and contends that the area should remain open, with warnings posted. A final decision has yet to be reached. Since the Forest Service has not reached consensus about what course of action to take should ordnance not be removed, it is difficult to quantify environmental consequences.

Ordnance presents an insidious risk to the public. Its presence and potential for harm are not readily recognizable by the public. The Forest Service, as managers of the wilderness, have an obligation to reduce the danger posed by the ordnance. While closure of the wilderness for human use appears to be a viable option to reduce risk, it would be extremely expensive to implement and enforce. There are many avenues of approach to the Dolly Sods Wilderness; all would have to be closed off, posted, and patrolled. The cost of closure would be high, both in dollars allocated for capital costs and enforcement, and to the public who would be deprived of the use of one of the most popular recreational resources in the eastern United States.

The wilderness ethic, "leave no trace," implies that man's use of wilderness areas should have little impact on the ecology of the area. Therefore, if man's use of the wilderness is restricted or banned, as could be the case if the no action alternative were selected, there should be no indirect impact. In reality, however, man's use does show signs of wear at the Dolly Sods Wilderness, particularly at campgrounds, campsites and trails. If use were limited or banned, these areas would grow over with second generation cover.

4.5. Appropriate Mitigation Measures not Already Included in the Proposed Action or Alternatives

Efforts have been made to involve technical specialists, resource agencies, regulatory agencies, wilderness managers, and the public in a dialogue to identify additional and appropriate mitigation efforts not already included in the proposed action. Many excellent suggestions have been passed forward and integrated into the work plan. Examples include:

- Weekly meetings will be held between Forest Service employees and Corps of Engineers/UXO specialists to discuss upcoming work. Issues of potential concern will be identified and specific plans will be made to mitigate impacts of the remediation effort.

- Individuals with expertise in archaeology and biology in the Monongahela National Forest will be available to provide guidance prior to proceeding should situations arise such as excavation of unknown items or artifacts or if activity is scheduled in areas known to be sites of endangered and threatened species.

- A Forest Service employee will be available on-site to provide oversight and technical assistance.

- An archaeologist will perform a visual survey of trails and campsites for archaeological resources prior to initiation of the ordnance removal project. A report documenting findings and specific recommendations will be provided for use by UXO contractors.

- Scientists knowledgeable in their fields and familiar with the Dolly Sods Wilderness will provide initial training to UXO personnel in identification of botanical species, historical artifacts, and other issues of concern. Trainers may include West Virginia Division of Natural Resources, Forest Service, and Corps of Engineers specialists, as well as recognized experts such as herpetologist Dr. Tom Pauley. This will help UXO personnel better understand the Dolly Sods Wilderness and appropriate behaviors from an archaeological and biological perspective.

- Wilderness experts, such as Steve Hollenhorst, will provide training to UXO crews in low-impact wilderness use. This will help the UXO crews learn good techniques to minimize their impact on the Dolly Sods Wilderness while performing daily activities.

- Concerned citizens have suggested that an effort is made to contact users of the Dolly Sods Wilderness through the use of past mailing lists. It has been recommended that users be warned of potential trail closings in advance, so that alternate sites could be selected for camping and hiking during the remediation effort. That way, recreational impacts would be minimized. The Forest Service has provided a mailing list to the Corps of Engineers. The Corps of Engineers will forward information about the project to all individuals on the list. In addition, the Corps of Engineers will attempt to expand the list by contacting individuals knowledgeable about the area such as academic researchers, recreation associations, etc. Newspapers will also be used to attempt to inform those not on the mailing lists.

- The Forest Service will provide signs and other information informing users of alternate sites within and outside of the Dolly Sods Wilderness. This will lessen the impact on recreational users.

5.0. AFFECTED ENVIRONMENT (Description of Affected Area)

In this section of the Environmental Assessment, the environment of the Dolly Sods Wilderness is described in the detail necessary to allow the reviewer to understand the effects of the alternatives. Forest service trails and inventoried campsites to be remediated are shown in Figure 5-1. Subsequent figures in this section will relate environmental and cultural resources to these remediation areas.

To describe the environment of the Dolly Sods Wilderness, resources were quantified. Resources addressed include:

- botanical,
- zoological/wildlife,
- wilderness,
- wetlands,
- environmental—air, water, soils, noise,
- cultural,
- socioeconomic.

Sources of information for this section include scientific literature; theses and dissertations; agency reports; personal communications with recognized experts; other environmental impact studies; and personal communications with interested individuals. While there is not a great deal of scientific literature, there is a wealth of oral information available from the many people who have strong feelings for the Dolly Sods Wilderness.

5.1. Botanical Resources

5.1.1. Investigative methods and resources

Botanical investigations conducted for preparation of this environmental assessment consisted of a review of existing literature and interviews with technical specialists. Due to the amount of information available, and the expertise of the author of this section, William Grafton, it was not necessary to perform a field survey. Grafton is a highly respected naturalist.

Various reports and data sources were reviewed:

- *Appalachian Corridor H, Supplemental Draft Environmental Impact Statement* (various reports)—This document was prepared by Michael Baker, Jr., Inc. One of the proposed highway routings passes through Canaan Valley. Dolly Sods Wilderness is on the ridge to the east of Canaan Valley. The Environmental Impact Study provides data on vegetation, sensitive species locations, and general information on the botanical resources in the area.

- *Feasibility Study Dolly Sods Wilderness Area: Final Work Plan for Surface and Subsurface Investigation and On-Site Disposal of Ordnance, 1991*—This document, prepared by Metcalf & Eddy, Inc., for the U.S. Army Corps of Engineers contains procedures for ordnance surveying and removal.

- *Feasibility Study Dolly Sods Wilderness Area: Engineering Report for Extent of OEW Contamination and Evaluation of Remedial Action Alternatives, 1992*—This document also prepared by Metcalf & Eddy, Inc., for the U.S. Army Corps of Engineers contains information collected during field studies at Dolly Sods Wilderness. It includes excellent field notes.

In addition to the documents mentioned above, several other data sources were reviewed to evaluate biological resources within the Dolly Sods Wilderness. Of great value were personal interviews with highly qualified technical experts:

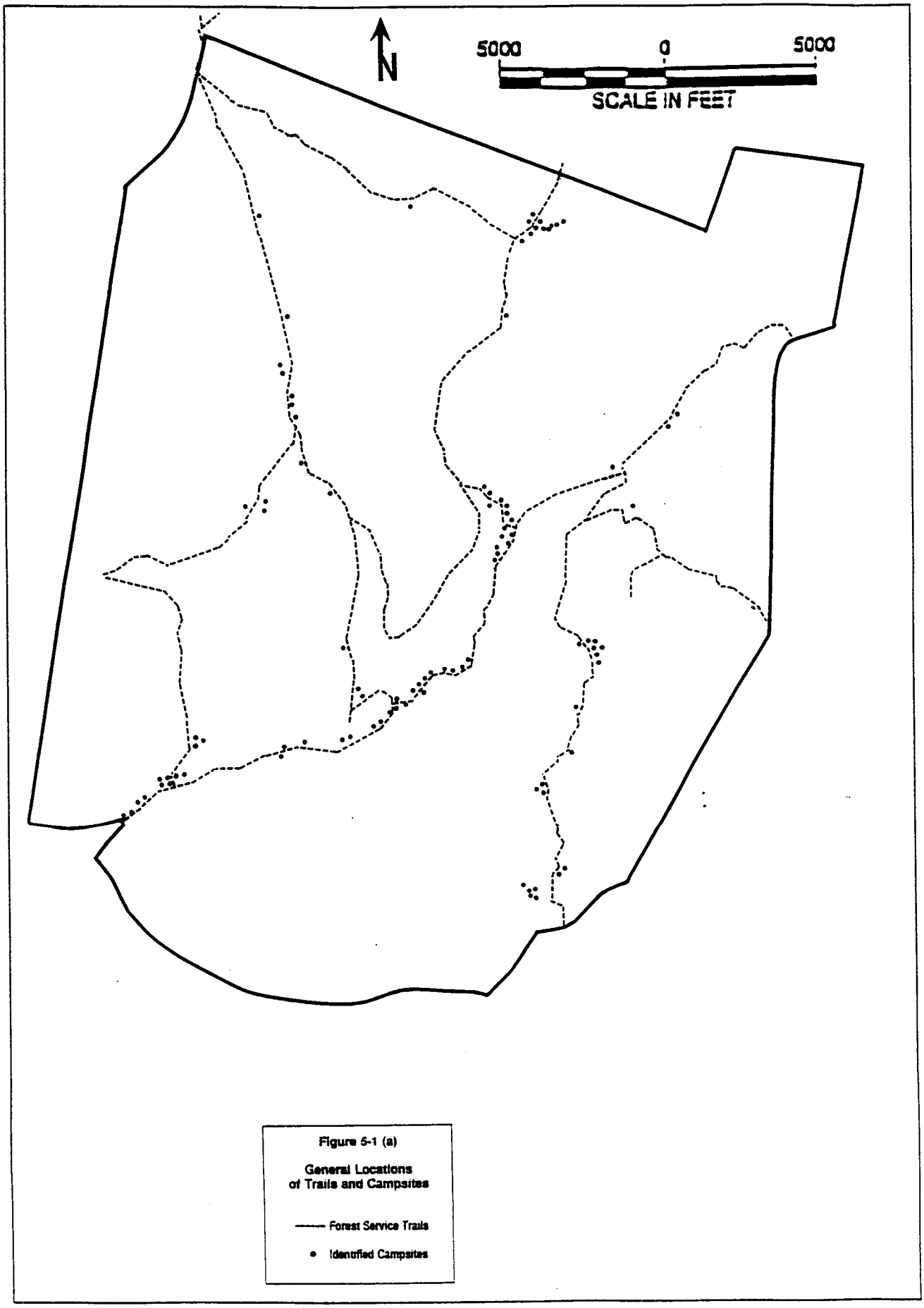
- **Harry Pawelczyk, Biologist, USDA Forest Service**—provided records of endangered, threatened, and sensitive plant species within the Monongahela National Forest. He also discussed ordnance survey and removal techniques, their effect on the botanical population, and mitigation techniques.

- **P.J. Harmon, Botanist, West Virginia Division of Natural Resources**—provided records of rare species and photo-documentation of the Dolly Sods Wilderness plant life. He also discussed ordnance survey and removal techniques, their effect on the botanical population, and mitigation techniques.

- **Barbara Sargent, Biologist, West Virginia Division of Natural Resources**—developed a map locating the West Virginia Division of Natural Resources' species of concern. By overlaying the map of trails and campsites with that of the species of concern, UXO specialists will be forewarned prior to entering an area.

- **William Tolin, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service**—discussed ordnance removal and appropriate mitigation techniques. He also addressed issues related to the Endangered Species Act.

- **William Grafton, Forester, West Virginia University Extension Service**—performed an evaluation of likelihood of occurrence of endangered, threatened, and sensitive, and rare species, and recommended mitigation plans. Grafton is a recognized expert naturalist on the flora of Dolly Sods.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SCALE IN FEET
Figure 5-1 (a)
General Locations
of Trails and Campsites
Forest Service Trails
Identified Campsites

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5.1.2. Inventory of Botanical Resources

Vegetation Types

The northern forest, as it occurs in the more than 14,000-acre Dolly Sods region, including the Wilderness and the adjacent Scenic Area, has many habitats and ecotones where habitats intergrade. Altitude varies from 3,200 feet to over 4,000 feet. Because of the high altitude and cold climate, Dolly Sods is similar to places 1,600 miles farther north. At lower elevations, hardwood species such as yellow birch, sugar maple, basswood, beech, and black birch are dominant. Balsam fir grows in a few wetter areas. Vegetational patterns vary. For instance, one site may have oak, maple, and basswood hardwoods, while maple, birch, American beech, or beech/birch may be dominant at another. Dolly Sods has transition zones of aspen groves and heath areas, and at higher elevations the trees are predominantly the climax red spruce.

Endangered, Threatened, and Sensitive Plant Species

The endangered, threatened, and sensitive plant species known to potentially occur within the Dolly Sods Wilderness area are included in Appendix III. The probability of occurrence is documented for these species.

The potential occurrence of endangered, threatened, and sensitive plant species within the Dolly Sods Wilderness is evaluated in this section. Generalized locations of rare plant populations, as designated by the West Virginia Division of Natural Resources, discovered during the intensive field surveys are shown on Figure 5-1(b). Sensitive plant species include (1) "listed" species; (2) "proposed" species; and (3) species of special concern. "Listed" plant species are officially listed as rare, threatened or endangered by the state government (West Virginia Division of Natural Resources), and/or the federal government (U.S. Fish and Wildlife Service (USFWS), 1989a). "Proposed" plant species are officially proposed for addition to the federal threatened and endangered species list.

Rare plant species are of interest to state, federal, or local resource agencies because they: (1) are of limited distribution; (2) may be experiencing populations declines; (3) may be vulnerable to known or future threats to their habitats or existence; and/or, (4) are of unusual scientific, recreational, or educational value. These species usually do not possess the same rarity and/or vulnerability as officially listed species; hence, the same legal protection is not afforded to these species. However, it is possible that some of these rare plant species may be added to official state and federal endangered species lists in the future. West Virginia lacks legislation to protect species so listed.

There are two general categories of rare species: (1) those species that are candidates for official federal listing as threatened and endangered (USFWS, 1989b; 1990); and, (2) those species which are not federal or state candidates, but which have been unofficially identified

as a species of special concern by private conservation organizations, the local biological community, or government agencies.

Federal candidate species are assigned to two categories depending on the current state of knowledge of the species and its biological appropriateness for listing (USFWS, 1989b, 1990). Category 1 candidate species include taxa for which the USFWS currently has on file substantial information on biological vulnerability and threats to support the appropriateness of proposing to list the taxa as an endangered or threatened species. Category 2 includes taxa for which sufficient information is available to indicate possible listing, but for which additional data are required on vulnerability and threats. Species which have been removed from the federal candidate list because they are more abundant or widespread than previously believed are assigned to Category 3c.

Rare plant species are included on several lists developed by the West Virginia Division of Natural Resources. The Division of Natural Resources has developed an extensive database on rare plants in West Virginia in cooperation with state agencies and the Nature Conservancy.

Endangered, threatened, and sensitive plant species, as compiled by the Forest Service, which have a possible likelihood of occurrence in the Dolly Sods Wilderness are listed in Table 5-1. For further details, refer to Appendix III-A.

Table 5-1
Endangered, Threatened and Sensitive Plant Species With a Possible Likelihood of Occurrence in the Dolly Sods Wilderness

Common Name	Scientific Name	Classification *
White Monkshood	*Aconitum reclinatum*	S
Harned's Swamp Clintonia	*Clintonia alleghaniensis*	S
Darlington's Spurge	*Euphorbia purpurea*	S, C2
White Alumroot	*Heuchera alba*	S
Long-Stalked Holly	*Ilex collina*	S
Jacob's Ladder	*Polemonium van-bruntiae*	S
Rock Skullcap	*Scutellaria saxatilis*	S
Ammon's Tortula	*Tortula ammonsiana*	S, C2
Running Buffalo Clover	*Trifolium stoloniferum*	E
Appalachian Blue Violet	*Viola appalachiensis*	S
Appalachian Shoestring Fern	*Vittaria appalachiana*	S

* E = Endangered, T = Threatened, S = Sensitive, C2 = Candidate for Federal Listing

The running buffalo clover (*Trifolium stoloniferum*) is the only endangered species with a possible likelihood of occurrence. It has been found close to Parsons, West Virginia, 15 miles from the Dolly Sods Wilderness. The plant thrives in disturbed areas, such as on old logging roads. Because it has been found in areas close to the Dolly Sods Wilderness, and because the wilderness has habitats which would support the running buffalo clover, there is a possible likelihood of occurrence. It is important to note, however, that the plant has not been found in the Dolly Sods Wilderness. It has a showy white blossom in May and June and is easy to differentiate from other clovers. No reports of its presence were made in May or June of 1995.

Rare Plant Species

The West Virginia Division of Natural Resources maintains a list of rare plants for the state of West Virginia. All of those plants are listed in Appendix III-B and are evaluated for potential occurrence. Rare plant species which have a possible likelihood of occurrence in the Dolly Sods Wilderness are summarized in Table 5-2.

Table 5-2
Rare Plant Species With a Possible Likelihood of Occurrence in the Dolly Sods Wilderness

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)
White Monkshood	*Aconitum reclinatum*	*Aconitum reclinatum*
Slender Wheatgrass	*Agropyron trachycaulum*	*Elymus trachycaulus* var. *trachycaulus*
A Bentgrass	*Agrostis borealis*	*Agrostis mertensii*
Northern Water Plantain	*Alisma triviale*	*Alisma triviale*
Oblong-Fruited Serviceberry	*Amelanchier bartramiana*	*Amelanchier bartramiana*
Paper Birch	*Betula papyrifera*	*Betula papyrifera*
A Reedgrass	*Calamagrostis neglecta*	*Calamagrostis stricta* ssp. *stricta*
Grass Pink Orchid	*Calopogon tuberosus*	*Calopogon tuberosus* var. *tuberosus*
Summer Sedge	*Carex aestivalis*	*Carex aestivalis*
Slough Sedge	*Carex atherodes*	*Carex atherodes*
A Sedge	*Carex bromoides*	*Carex bromoides*
Hoary Sedge	*Carex canescens*	*Carex canescens*
Bearded Sedge	*Carex comosa*	*Carex comosa*
Davis' Sedge	*Carex davisii*	*Carex davisii*

Table 5-2
Rare Plant Species With a Possible Likelihood of Occurrence in the Dolly Sods Wilderness (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)
Emory's Sedge	*Carex emoryi*	*Carex emoryi*
Howe's Sedge	*Carex howei*	*Carex atlantica* ssp. *capillacea*
Lake Sedge	*Carex lacustris*	*Carex lacustris*
Wooly Sedge	*Carex lanuginosa*	*Carex pellita*
A Sedge	*Carex lasiocarpa*	*Carex lasiocarpa*
Nerveless Wood Sedge	*Carex leptonervia*	*Carex leptonervia*
Few-Seeded Sedge	*Carex oligosperma*	**Removed from tracking list**
Few-Flowered Sedge	*Carex pauciflora*	*Carex pauciflora*
Variable Sedge	*Carex polymorpha*	*Carex polymorpha*
A Sedge	*Carex projecta*	*Carex projecta*
Weak Stellate Sedge	*Carex seorsa*	**Removed from tracking list**
A Sedge	*Carex styloflexa*	*Carex styloflexa*
A Sedge	*Carex trichocarpa*	*Carex trichocarpa*
Purple Virgin's Bower	*Clematis verticillaris*	*Clematis occidentalis* var. *occidentalis*
Hamed's Clintonia	*Clintonia alleghaniensis*	*Clintonia alleghaniensis*
Early Coralroot	*Corallorrhiza trifida*	*Corallorrhiza trifida*
Beaked Dodder	*Cuscuta rostrata*	*Cuscuta rostrata*
Fraser's Sedge	*Cymophyllus fraseri*	*Cymophyllus fraserianus* **Removed from tracking list**
Showy Lady's-Slipper	*Cypripedium reginae*	*Cypripedium reginae*
Star Violet	*Dalibarda repens*	*Dalibarda repens*
Sundew	*Drosera rotundifolia*	*Drosera rotundifolia*
Woodland Horsetail	*Equisetum sylvaticum*	*Equisetum sylvaticum*
Vervain Thoroughwort	*Eupatorium pilosum*	*Eupatorium pilosum*
Darlington's Spurge	*Euphorbia purpurea*	*Euphorbia purpurea*
Purple Avens	*Geum rivale*	*Geum rivale*
Yellow Avens	*Geum strictum*	*Geum aleppicum*

Table 5-2
Rare Plant Species With a Possible Likelihood of Occurrence in the Dolly Sods Wilderness (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)
A Manna-Grass	*Glyceria acutiflora*	*Glyceria acutiflora*
A Manna-Grass	*Glyceria canadensis* var *laxa*	*Glyceria laxa*
A Manna-Grass	*Glyceria fernaldii*	*Torreyochloa pallida* var. *fernaldii*
A Manna-Grass	*Glyceria grandis*	*Glyceria grandis*
A Manna-Grass	*Glyceria pallida*	*Torreyochloa pallida* var. *pallida*
Appalachian Oak Fern	*Gymnocarpium appalachianum*	*Gymnocarpium appalachianum*
Canada Frostweed	*Helianthemum canadense*	*Helianthemum canadense*
White Alumroot	*Heuchera alba*	*Heuchera alba*
Long-Stalked Holly	*Ilex collina*	*Ilex collina*
Jointed Rush	*Juncus articulatus*	*Juncus articulatus*
Thread Rush	*Juncus filiformis*	*Juncus filiformis*
Torrey's Rush	*Juncus torreyi*	*Juncus torreyi*
Highland Rush	*Juncus trifidus*	*Juncus trifidus*
One-Flowered Rush	*Juncus trifidus* ssp *carolinianus*	*Juncus trifidus*
A Pinweed	*Lechea leggettii*	*Lechea pulchella* var. *pulchella*
Pale Duckweed	*Lemna valdiviana*	*Lemna valdiviana*
Heartleaf Twayblade	*Listera cordata*	*Listera cordata* var. *cordata*
Kidney-Leaf Twayblade	*Listera smallii*	*Listera smallii*
Fly Honeysuckle	*Lonicera canadensis*	*Lonicera canadensis*
Long-Lobe Arrowhead	*Lophotocarpus calycinus*	*Sagittaria calycina* var. *calycina*
Ostrich Fern	*Matteuccia pensylvanica*	*Matteuccia struthiopteris*
A Mountain Ricegrass	*Oryzopsis asperifolia*	*Oryzopsis asperifolia*
A Mountain Ricegrass	*Oryzopsis canadensis*	*Oryzopsis canadensis*
Black-Fruit Mountain Ricegrass	*Oryzopsis racemosa*	*Oryzopsis racemosa*
Drooping Bluegrass	*Poa saltuensis*	*Poa saltuensis*
Rose Pogonia	*Pogonia ophioglossoides*	*Pogonia ophioglossoides*

Table 5-2
Rare Plant Species With a Possible Likelihood of Occurrence in the Dolly Sods Wilderness (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)
A Jacob's Ladder	*Polemonium van-bruntiae*	*Polemonium van-bruntiae*
Balsam Poplar	*Populus balsamifera*	*Populus balsamifera*
Three-Toothed Cinquefoil	*Potentilla tridentata*	*Sibbaldiopsis tridentata*
Blunt Mountain-Mint	*Pycnanthemum muticum*	*Pycnanthemum muticum*
Alder-Leaved Buckthorn	*Rhamnus alnifolia*	*Rhamnus alnifolia*
Bristly Black Currant	*Ribes lacustre*	*Ribes lacustre*
Swamp Red Currant	*Ribes triste*	*Ribes triste*
Glaucous Willow	*Salix discolor*	*Salix discolor*
Swamp Saxifrage	*Saxifraga pensylvanica*	*Saxifraga pensylvanica*
Black-Girdle Bullrush	*Scirpus atrocinctus*	*Scirpus atrocinctus*
A Woolgrass	*Scirpus rubrotinctus*	*Scirpus microcarpus*
Rock Skullcap	*Scutellaria saxatilis*	*Scutellaria saxatilis*
Starflower False Solomon's-Seal	*Smilacina stellata*	*Maianthemum stellatum*
Staminate Burreed	*Sparganium androcladum*	*Sparganium androcladum*
Northern Stitchwort	*Stellaria calycantha*	*Stellaria borealis* ssp. *borealis*
Bog Fern	*Thelypteris simulata*	*Thelypteris simulata*
Running Buffalo Clover	*Trifolium stoloniferum*	*Trifolium stoloniferum*
Large Cranberry	*Vaccinium macrocarpon*	*Vaccinium macrocarpon*
Small Cranberry	*Vaccinium oxycoccos*	*Vaccinium oxycoccos*
Marsh Speedwell	*Veronica scutellata*	*Veronica scutellata*
Highbush Cranberry	*Viburnum trilobum*	*Viburnum opulus* var. *americanum*
Appalachian Blue Violet	*Viola appalachiensis*	*Viola appalachiensis*
Appalachian Shoestring Fern	*Vittaria appalachiana*	*Vittaria appalachiana*
Yellow-Eyed Grass	*Xyris torta*	*Xyris torta*
Oceanorus	*Zigadenus leimanthoides*	*Zigadenus leimanthoides*

5.2. Zoological/Wildlife Resources

5.2.1. Investigative Methods and Resources

The investigation conducted for preparation of this environmental assessment consisted of a review of existing literature and interviews with technical specialists. This section was authored by Dr. Thomas K. Pauley, B.S. Biology, M.S. Biology, Ph.D. Biology and Ecology and Deborah Wegmann. Dr. Pauley is the author of over 50 abstracts/papers dealing with amphibians and reptiles, co-author of the only book on amphibians and reptiles in West Virginia, and has taught herpetology, ornithology, and conservation biology for nearly 30 years in several colleges and universities.

In addition, a biological assessment was conducted to determine the impact of the proposed ordnance removal on rare and endangered species known to exist in the Dolly Sods Wilderness. The biological assessment also addressed techniques for mitigation. It is presented in Appendix IV.

Various reports and data sources were reviewed:

- *Appalachian Corridor H, Supplemental Draft Environmental Impact Statement* (various reports)—This document was prepared by Michael Baker, Jr., Inc. The Dolly Sods Wilderness is included in the geographical study for the proposed highway. The Environmental Impact Study provides data on zoological species habits and locations, as well as general information on the resources of the area.

- *Feasibility Study Dolly Sods Wilderness Area: Final Work Plan for Surface and Subsurface Investigation and On-Site Disposal of Ordnance, 1991*—This document, prepared by Metcalf & Eddy, Inc. for the U.S. Army Corps of Engineers contains procedures for ordnance surveying and removal.

- *Feasibility Study Dolly Sods Wilderness Area: Engineering Report for Extent of OEW Contamination and Evaluation of Remedial Action Alternatives, 1992*—This document, also prepared by Metcalf & Eddy, Inc. for the U.S. Army Corps of Engineers contains information collected during field studies at Dolly Sods Wilderness. It includes excellent field notes.

- *Cheat Mountain Salamander Recovery Plan*—Developed for the U.S. Fish and Wildlife Survey, this report relates survey results for the Monongahela National Forest, of which the Dolly Sods Wilderness is a small part. Location and habitat are well documented. Also, practices which can be applied to mitigation planning are addressed.

- *Appalachian Northern Flying Squirrel Recovery Plan*—Developed for the U.S. Fish and Wildlife Survey, this report relates survey results for the Monongahela National Forest.

- *Biological Evaluation of Effects on Endangered, Threatened, and Sensitive Animal Species in the Ordnance Removal Project in the Dolly Sods Wilderness*— Developed for the U.S. Army Corps of Engineers, this report assesses the potential impact of the ordnance removal project on the Dolly Sods Wilderness.

In addition to the documents mentioned above, several other data sources were reviewed to evaluate zoological resources within the Dolly Sods Wilderness. Of great value were personal interviews with highly qualified technical experts:

- **William Tolin, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service**—provided maps of known locations of the Cheat Mountain salamander. In addition, he addressed ordnance removal techniques, probable impacts and mitigation methods.

- **Harry Pawelczyk, Biologist, USDA Forest Service**—provided records of endangered, threatened, and sensitive species within the Monongahela National Forest.

- **LeJay Graffious, President, Brooks Bird Club**—reviewed work plan and provided recommendations. He also provided information about bird populations at the Dolly Sods Wilderness.

- **Walter Lesser, Biologist, West Virginia Division of Natural Resources, Wildlife Biologist**—provided an overview of wildlife in the Dolly Sods Wilderness. He addressed potential impacts of the proposed action and mitigation techniques.

- **Allen Glasscock, Wildlife Specialist, West Virginia Division of Natural Resources**—provided an overview of wildlife in the Dolly Sods Wilderness.

- **Tom Pauley, Biologist, Marshall University**—provided a biological assessment of the impact of the project on species of concern in the Monongahela National Forest.

5.2.2. Inventory of Zoological/Wildlife Resources

The zoological species known to potentially occur within the Dolly Sods Wilderness region are included in Appendix IV. The probability of occurrence is documented for these species. Generalized locations of populations of the two endangered/threatened species discovered during field surveys are included as Figure 5-1(c).

An evaluation of the likelihood of occurrence in the Dolly Sods Wilderness of endangered, threatened, and sensitive zoological species is presented in Table 5-3. For further details, refer to Appendix IV.

Table 5-3
Evaluation of Likelihood of Occurrence of Endangered, Threatened and Sensitive Zoological Species in the Dolly Sods Wilderness

THREATENED/ENDANGERED SPECIES Name/Status/Habitat	Likelihood of Occurrence	Classification *
MAMMALS		
Gray Wolf (*Canis lupus*) High spruce forests and associated northern mixed hardwood/coniferous forest. The last wolf in the state was killed in 1900.	Unlikely; extirpated from WV.	E/SH
Virginia Big-eared Bat (*Plecotus townsendii virginianus*) In winter, hibernates in selected suitable caves. In summer, roosts in selected caves. Found in Preston, Grant, Tucker, Hardy, Pendleton, and Randolph counties.	Unlikely; no suitable habitat in project area.	E/G5/T2/S2
Eastern Cougar (*Felis concolor couguar*) Expansive, isolated mountainous areas; hardwood or mixed forests.	Unlikely; extirpated from WV.	E/G4TH/SH
Indiana Bat (*Myotis sodalis*) In winter, hibernates in selected caves. Known from Preston, Tucker, Pendleton, Randolph, Pocahontas, Hardy, Monroe, and Greenbrier counties.	Unlikely; no suitable habitat in project area.	E/G2/S1
Virginia Northern Flying Squirrel (*Glaucomys sabrinus*) Coniferous, mixed deciduous/coniferous northern hardwood forests with some 10"+ DBH trees and partial canopy closure. Lowest recorded elevation is 2,860'. Known from Randolph, Greenbrier, Webster, Tucker, Pocahontas, and Pendleton counties.	Present; known population and suitable habitat in project area.	E/G5T2/S2

* See key on Page 9-IV-C-13

Table 5-3
Evaluation of Likelihood of Occurrence of Endangered, Threatened and Sensitive Zoological Species in the Dolly Sods Wilderness
(Continued)

THREATENED/ENDANGERED SPECIES **Name/Status/Habitat**	**Likelihood of Occurrence**	**Classification ***
BIRDS		
Peregrine Falcon (*Falco peregrinus anatum*) Nest sites located on cliffs, ground, buildings, and bridges. Isolation from human disturbance. Historic nest sites in Grant, Pendleton, Hampshire, Mineral, Morgan, Wyoming, and Greenbrier counties. A recent nest site in Grant County.	Possible; suitable habitat may be present in Red Creek Canyon.	E/G3/S1
Bald Eagle (*Haliaeetus leucocephalus*) Nest in tall trees or on cliffs near large rivers or lakes. Known nesting sites in Hardy and Grant counties.	Unlikely; no suitable habitat.	T/G3/S1
AMPHIBIANS		
Cheat Mountain Salamander (*Plethodon nettingi*) Moist spruce/deciduous forests, including but not limited to shaded or moist coves, possibly with rhododendron and/or small emergent rocks within a spruce or hemlock forest. Spruce stands containing *Bazzania* (a liverwort). Minimum elevation 2,600'. Boundary of range: North at Blackwater Canyon, extending east to Dolly Sods, south to Spruce Knob, west to Thorny Flat, north through Barton Knob to Blackwater Canyon. Known to occur in Grant, Pendleton, Randolph, Tucker, and Pocahontas counties.	Present; known populations and suitable habitat in project area.	T/G2/S2
SENSITIVE SPECIES		
MAMMALS		
Southern Rock Vole (*Microtus chrotorrhinus carolinensis*) Moist talus or among mossy rocks and logs in spruce and northern hardwood forests, often birch, hemlock and other hardwoods. Ground cover of mosses, ferns, and northern herbs. Unvegetated talus, grass balds, recent clearcuts, and roadfills. Favors moist situations and higher elevations. Highly associated with permanent water. Found in Tucker, Randolph, Pendleton, Pocahontas, and Greenbrier counties.	Possible; suitable habitat available, but species is not known from the project area.	C2/G5T3/S3

* See key on page 9-IV-C-13

Table 5-3
Evaluation of Likelihood of Occurrence of Endangered, Threatened and Sensitive Zoological Species in the Dolly Sods Wilderness
(Continued)

SENSITIVE SPECIES Name/Status/Habitat	Likelihood of Occurrence	Classification *
MAMMALS (Continued)		
Eastern Small-footed Bat (*Myotis leibii*) Old buildings, rock crevices, rock slabs, stones and caves. Found in Preston, Tucker, Randolph, Grant, Pendleton, Pocahontas, Greenbrier, Monongalia, and Monroe counties.	Possible; suitable habitat available, but species is not known from the project area.	C2/G3/S2S3
Allegheny Woodrat (*Neotoma magister*) Extensive rocky areas, outcrops, cliffs, talus slopes with boulders, crevices and caves. Also, river banks with sandstone rocks and boulders. Occurs nearly statewide.	Probable; suitable habitat available, but species is not known from the project area.	C2/G5T4Q
Appalachian/Southern Water Shrew (*Sorex palustris punctulatus*) In or near swiftly-flowing rocky streams. In or near northern hardwood forests, dominant trees being yellow birch and red maple, with dense rhododendron understory. Found in Preston, Tucker, Randolph, Pendleton, and Pocahontas counties.	Possible; suitable habitat available, but species is not known from the project area.	C2/G4/S3
Appalachian Cottontail (*Sylvilagus obscurus*) Cool, high elevation woods with dense, shrubby understory. Also 6-7 year old clearcuts and overgrown farmsteads. Mixed yellow birch-red maple, with glades of red spruce, rhododendron small irregular shrubby openings. Areas of hemlock and rhododendron in oak-hickory forests. Probably occurs in most higher elevations.	Probable; suitable habitat in project area.	C2/G4/S3

* See key on page 9-IV-C-13

Table 5-3
Evaluation of Likelihood of Occurrence of Endangered, Threatened and Sensitive Zoological Species in the Dolly Sods Wilderness
(Continued)

SENSITIVE SPECIES Name/Status/Habitat	Likelihood of Occurrence	Classification *
BIRDS		
Northern Goshawk (*Accipiter gentilis*) Coniferous, deciduous and mixed forests. Utilizes a variety of forest types, structural conditions and successional stages. Recorded in Randolph, Tucker, and Pocahontas counties.	Possible; suitable habitat may be available. Species is not known from project area.	C2/G4
Cerulean Warbler (*Dendroica cerulea*) Mature deciduous forest, particularly in floodplains or other mesic conditions. Common through western hills of West Virginia, but becomes uncommon and local toward the Alleghenies. Greatest numbers found below 1,980'.	Unlikely; no suitable habitat in project area.	C2/G4
AMPHIBIANS		
Green Salamander (*Aenides aeneus*) Found in rock crevices in rock faces, well-shaded and moist, under bark on trees, and in rotting logs. Deciduous or deciduous/coniferous or rocky habitats.	Possible; suitable habitat may be available, but species is not known from the project area.	C2/G4/SE
Hellbender (*Cryptobranchus alleganiensis*) Found in larger permanent streams that are cool and clear. Remains in calm pools during the day and moves to the rapids at night to feed.	Unlikely; no suitable habitat in project area.	C2/G4
FISH		
Candy Darter (*Etheostoma osburni*) Rocky riffles of small streams to medium-sized rivers with cool to cold temperatures. Gauley and New River drainages.	Unlikely; outside of known range.	C2/G3/S1
Kanawha Minnow (*Phenecobius teretulus*) Riffles and runs of medium to large streams with gravel, rubble or boulder substrate. Upper Gauley River and New River tributaries.	Unlikely; outside of known range.	C2/G3/S1

* See key on page 9-IV-C-13

Table 5-3
Evaluation of Likelihood of Occurrence of Endangered, Threatened and Sensitive Zoological Species in the Dolly Sods Wilderness (Continued)

SENSITIVE SPECIES Name/Status/Habitat	Likelihood of Occurrence	Classification *
FISH (Continued)		
Cheat Minnow (*Rhinichthys bowseri*) Small to large rubble substrates, small runs and riffles of small streams to medium rivers. From drainages of the Cheat, Tygart Valley, Monongahela and Youghiogheny Rivers. Possibly the upper Greenbrier River.	Possible; suitable habitat may be available, but species is not known from the project area.	C2/G1/S2
INVERTEBRATE SPECIES		
Cheat Valley Cave Isopod (*Caecidotea cannulus*) Found under flat rocks in subterranean streams and pools in caves. Only known to occur in southern Tucker and Randolph counties.	Unlikely; no suitable habitat in project area.	C2/G2/S1
Holsinger's/Greenbrier Valley Cave Isopod (*Caecidotea holsingeri*) The most common and widespread troglobitic isopod in West Virginia. In cave stream gravel, under rocks, on decaying wood in streams and occasionally in drip pools.	Unlikely; no suitable habitat in project area.	G3/S3
Organ Cave Snail (*Fontigens tartarea*) Found under flat rocks in streams with moderate current. Only known from selected caves in Greenbrier, Tucker, Randolph, and Pocahontas counties.	Unlikely; no suitable habitat in project area.	G3/S3
Green Floater (*Lasmigona subviridis*) Fine gravel and sand in backwater and slower water. Patchy occurrence in small to large rivers away from fast current and large boulders. Currently in Greenbrier River and Clover Creek. Past record from the New River drainage. Any Greenbrier River tributary is potential habitat. Two sites on the west fork of the Greenbrier above Durbin. Potentially from Cass south on the Greenbrier. Possible at Deer Creek.	Unlikely; outside of known range.	C2/G3/S1

* See key on page 9-IV-C-13

Table 5-3
Evaluation of Likelihood of Occurrence of Endangered, Threatened and Sensitive Zoological Species in the Dolly Sods Wilderness
(Continued)

SENSITIVE SPECIES Name/Status/Habitat	Likelihood of Occurrence	Classification *
INVERTEBRATE SPECIES (Cont.')		
Elktoe (*Alasmidonta marginata*) Sandy gravel and cobble substrate in good currents; not found in muddy water. Only known from the Greenbrier River, Cloverlick down through Hosterman, possible up to Durbin and the lower West Fork located south of Little River.	Unlikely; outside of known range.	C2
A Spider (*Phaneta subterranea*) A common troglobite in caves throughout most of the eastern United States. Usually near damp, decaying organic debris. In West Virginia, known from 27 caves in 9 counties.	Unlikely; no suitable habitat in project area.	G3/S3
Dry Fork Valley Cave Beetle (*Pseudanophthalmus montanus*) Occurs in twilight zone or deeper in selected caves. Also in or on moist soil, often near streams or drip areas, often under rocks or debris. Only known from 4 West Virginia caves in Tucker and Randolph counties.	Unlikely; no suitable habitat in project area.	C2/G1/S1
West Virginia Blind Cave Millipede (*Trichopetalum krekeleri*) In selected caves, under rocks, around organic debris, or on damp silt banks near streams. Known from only 5 West Virginia caves.	Unlikely; no suitable habitat in project area.	G1/S1
Looper Moth (*Euchlaena milnei*) Found on dry ridges in eastern portion of the state, extending from north to south border of the state. Range ends where northern hardwoods start. Specimens have been taken in Smoke Hole region of the Potomac Ranger District down through Reed's Creek.	Unlikely; no suitable habitat in project area.	C2/GU/S?

* See key on page 9-IV-C-13

5.3. Wilderness Resources

5.3.1. Investigative Methods and Resources

Various reports and data sources were reviewed to evaluate wilderness resources within the Dolly Sods Wilderness. To better understand wilderness management philosophies of the Forest Service, the managers of the area, the District Ranger, Nancy Feakes, and the Wilderness Specialist, Joe Robles, provided excellent information and insight. Of great value were discussions with Steven Hollenhorst, Assistant Professor of Wildlands Recreation at West Virginia University. Literature reviewed included:

- *The Dolly Sods Area*—(Sept. 1973), WV Highlands Conservancy
- *Management Plan for Dolly Sods*—(1969), Helen McGinness, Monongahela National Forest.
- *Dolly Sods Wilderness Area Study: Draft Report*, Hollenhorst and Stull-Gardner, West Virginia University, 1991.

5.3.2. Inventory of Wilderness Resources

Congress established the Dolly Sods Wilderness in 1975 to preserve and protect an area with special opportunities for solitude, primitive recreation, and scientific, educational, scenic, and historic opportunities. Unlike large wilderness areas in the western United States, where large tracts of untrammelled lands have been designated, many eastern wilderness areas like Dolly Sods often have been substantially disturbed ecologically in the past. Management practices focus on allowing the forces of nature to reclaim the area, returning it to its former natural state.

The Dolly Sods Wilderness is under the jurisdiction of the USDA Forest Service. Current Forest Service regulations govern practices in the area. Open areas in Dolly Sods, including bogs and heaths, are evolving and growing towards hardwoods and climax red spruce forest. In other words, the areas are returning to the condition found in times prior to human settlement. Logging and subsequent forest fires destroyed the forest originally covering the area.

The open bogs and heaths of Dolly Sods, which are unique to the area, could be preserved as they are now by controlled burning of vegetation. However, since controlled burning for forest management and habitat improvement is not allowed in the wilderness area, it is possible that some open areas will revert to woodlands.

Dolly Sods Wilderness has one of the highest use rates of any wilderness site in the east. It is estimated that 25,000 people use the wilderness area for hiking and camping annually.

Steven Hollenhorst, West Virginia University assistant professor of wildlands recreation, and Lisa Stull-Gardner, graduate assistant, studied Dolly Sods Wilderness use in 1991. From that study, they developed excellent information regarding wilderness use. They found that most visitors to the Dolly Sods Wilderness were from the mid-Atlantic: Virginia 33%, Maryland 22%, West Virginia 17%, and Pennsylvania 11%. The majority of visitors (81.5%) spent at least one night in the Dolly Sods Wilderness. Most visitors came on weekends. The primary activities were hiking on trails (99%), camping (78.3%), and hiking off trails (65.2%). An analysis of the importance of activities to visitors is provided in Table 5-4. It should be noted that this study was conducted in September. Hunting may not have been recognized as an important activity because hunters generally do not frequent the area until October and, therefore, may not have participated in the study.

Hollenhorst and Stull-Gardner found that hikers used some trails more than others. The Red Creek trail was the most frequently visited, with the Laneville segment receiving the highest amount of use. It is estimated that over 50% of trail use in the Dolly Sods Wilderness was concentrated on the Red Creek trail. Blackbird Knob and Fisher Spring trails were also heavily used. Trail use intensity is summarized in Figure 5-2.

Table 5-4
Visitors' Most Important Activity.
Dolly Sods Wilderness Study, September 1991

Activity	% Indicating Most Important
Hiking on trails	44.4%
Camping	23.3%
Spending time alone	8.9%
Nature study	6.7%
Hiking off trails	3.3%
Swimming or sunbathing	3.3%
Fishing	1.1%
Photography	1.1%
Hunting	-0-
Checking out places to hunt	-0-
Collecting berries, mushrooms	-0-
Picnicking	-0-
Horseback riding	-0-

Source: Dolly Sods Wilderness Area Study: Draft Report.
(1991) Hollenhorst and Stull-Gardner.

also prepared by Metcalf & Eddy, Inc., for the U.S. Army Corps of Engineers contains excellent field notes which document specific detailed observations of campsite ecosystems.

- *Dolly Sods*—written by Norma Jean Venable and published by the West Virginia University Extension Service, this booklet provides a general overview of Dolly Sods, including the wilderness area.

- *Screening Procedures to Evaluate Effects of Air Pollution on Eastern Region Wildernesses Cited as Class 1 Air Quality Areas*—(Gen. Tech. Report NE-151. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station) this report, prepared by M. B. Adams, D. S. Nichols, C. A. Federer, K. F. Kenses, and H. Parrot (1991), provides information regarding baseline environmental quality.

- *Artificial Watershed Acidification on the Femow Experimental Forest, USA*—this report, prepared by M. B. Adams, P. J. Edwards, F. Wood, and J. N. Kochenderfer (1993) and published in the Journal of Hydrology, provides information regarding baseline environmental quality.

- *Long-term Ionic Increases From a Central Appalachian Forested Watershed*—this report, prepared by P. J. Edwards and J. D. Helvey (1991) and published in the Journal of Environmental Quality [20(1)], provides information regarding baseline environmental quality.

- *Effects of Forest Fertilization on Stream Water Chemistry in the Appalachians*—this report, prepared by P. J. Edwards, J. N. Kochenderfer, and D. W. Seagrist (1991) and published in the Water Resources Bulletin [27(2)], provides information regarding baseline environmental quality.

- *The Effects of Watershed Acidification on Soil Water and Stream Water Chemistry*—this report, prepared by P. J. Edwards and F. Wood (1992), shows the proceedings of the 1992 Spring Meeting of the American Geophysical Union, Canadian Geophysical Union, and Mineralogical Society of America, May 12-16, 1992, in Montreal, Canada and provides information regarding baseline environmental quality.

- *Lichen Biomonitoring Program in the Dolly Sods and Otter Creek Wildernesses of the Monongahela National Forest: A Resurvey of Lichen Floristics and Elemental Status*—prepared by James D. Lawrey, this Final Report to the Forest Supervisor, Monongahela National Forest, USDA-Forest Service, George Mason University, Fairfax, Virginia, provides information regarding baseline environmental quality.

In addition to the documents mentioned above, several other data sources were reviewed to evaluate environmental resources within the Dolly Sods Wilderness. Of great value were personal interviews with highly qualified technical experts:

- **Barry Edgerton, Hydrologist, USDA Forest Service**—provided information related to baseline environmental quality at the Dolly Sods Wilderness.

5.5.2. Inventory of Environmental Resources

5.5.2.1. Water Quality

Dolly Sods Wilderness is located between 3,200 and 4,100 feet above sea level. In general, the terrain is quite rocky and rugged and the plant and animal life is comparable to that of Northern Canada. Several notable topographic features include Red Creek and its tributary runs, Breathed Mountain and other knobs, and the "sods" or bogs in the more level areas of the wilderness area.

Red Creek runs from the northern boundary to the southwest corner of Dolly Sods Wilderness dividing the wilderness area roughly in half. Its several tributaries include Stonecoal Run and Fisher Spring Run. Stonecoal Run is the longest tributary of Red Creek in the Dolly Sods Wilderness. It runs from the northwest corner of the wilderness area to the southern part of the wilderness, where it separates from Red Creek around Breathed Mountain. Little Stonecoal Run is to the west of the larger Stonecoal Run and flows roughly parallel to it. Fisher Spring Run flows from the bogs in the northeast corner of the wilderness area southwest to the center of the wilderness where it joins Red Creek. Close to the northern edge of the Dolly Sods Wilderness, the Left Fork branches off of Red Creek.

The sods, or bogs, are located mostly in the northern part of the wilderness area and can be found primarily at the headwaters of the runs and streams of the area. Large areas of sods are located in the level areas at the head of Fisher Spring Run and an unnamed tributary of Red Creek. These sods are marshy and contain different types of vegetation than is found in the surrounding forest.

All streams within the Dolly Sods Wilderness are designated by the state of West Virginia as National Resource Waters. These streams are afforded the highest level of protection from environmental degradation. There is an anti-degradation policy with no new sources of discharges permitted by the West Virginia Department of Environmental Protection.

Aquatic resources in the Dolly Sods Wilderness are limited to streams and wetlands; there are no lakes. Most perennial streams in such wildernesses are acidic and unproductive, with little or no acid neutralizing capacity, and many have elevated aluminum concentrations. Most of these streams do not support, or only seasonally support, native brook trout.

Water quality data collected in Dolly Sods demonstrates that aquatic resources are being severely stressed by acid water conditions. Water monitoring conducted between 1991 and 1993 demonstrated that all streams located primarily in the Pottsville Group (Pennsylvanian-age bedrock) are highly acid, pH is routinely below 5.0, and acid neutralizing capacity is extremely low (less than 10 µeq/l) or negative. Even the main Red Creek, which drains Dolly Sods and flows through some Mississippian-age Mauch Chunk bedrock, maintains acidic water conditions (pH 4.8 to 5.7) during the dormant season, and pH falls below 6.0 during summer episodes. Where Red Creek leaves the Dolly Sods Wilderness, after mixing with poorer quality tributaries, pH is even lower. Smaller tributaries remain highly acid year around.

The Pennsylvanian-age bedrock is the overwhelmingly dominant bedrock type within the wilderness. It occupies the upper elevations and more than 90% of the watershed area. Streams that arise and flow through the Lower Pennsylvanian rocks tend to be too acidic to support fish, while streams influenced by Mississippian-age rocks have improved water quality and are more suitable for aquatic life. Some of the Allegheny and Pottsville strata contain pyrite, which produces sulfate and acid as it oxidizes. Acid-forming materials in the bedrock of the watersheds are a source of natural acidity in the streams of the wilderness.

In addition to natural sources of acidity, both Dolly Sods Wilderness and nearby Otter Creek Wilderness receive the highest acid load from atmospheric deposition of all Class 1 wildernesses in the northeastern United States. Precipitation is among the most acidic in the nation. Precipitation averages 55 inches per year in Dolly Sods and Otter Creek, with average annual pH of 4.2, but pH below 4.0 is common during summer months. The mean annual total deposition of sulfur is estimated to be 21 kilograms per hectare (kg/ha), and 16 kg/ha of nitrogen. Mean annual sulfur dioxide (SO_2) concentration, derived from Regional Atmospheric Deposition Model (RADM), has been estimated to be 20.3 µg/m^3 for Dolly Sods and Otter Creek.

Aluminum analysis in spring baseflow conditions showed that dissolved aluminum and monomeric aluminum are very high in these streams. In most of these wilderness streams during spring baseflow, dissolved aluminum concentrations are 200 micrograms per liter (µg/l) or higher, and in several streams greater than 600 µg/l. Inorganic monomeric aluminum exceeded 100 µg/l in all but two streams, and exceeded 215 µg/l in 7 of 12 stream monitoring sites. In March of 1992, at four sites 300 µ/l was exceeded. Inorganic monomeric aluminum is considered the most toxic form of aluminum for aquatic biological effects, and the threshold of toxicity is considered to be 200 µg/l for eastern brook trout and lower for some other fish species. Many of the wilderness streams already exceed that toxicity threshold.

In *Screening Procedures to Evaluate Effects of Air Pollution on Eastern Region Wildernesses Cited as Class 1 Air Quality Areas* (1991), it was reported that indications of increased acidity of streams in Dolly Sods and Otter Creek already exist, due to acid deposition. West

Virginia Division of Natural Resources data show a long-term trend of increasing stream acidity and fish population effects in poorly-buffered mountain streams. Some of these streams show a recent loss of fish due to acidification processes.

As stated in the Forest Service Eastern Region's screening document, the aquatic ecosystems of the Dolly Sods Wilderness are under considerable stress from a combination of natural and deposition-derived acidity. Additional acidic loadings from sulfur and nitrogen deposition will further stress the aquatic ecosystems, and will jeopardize the existing populations of fish and other aquatic organisms.

Precipitation data collected nearby in Parsons, West Virginia by the USDA Forest Service, Northeastern Forest Experiment Station, documents that precipitation in this area is among the most acidic in the nation. The average annual pH of precipitation is 4.2, and commonly falls below pH 4.0 in the summer months. The combination of high precipitation and high acidity means that these wildernesses are exposed to very heavy loading of the acidifying pollutants, primarily sulfur (21 kg/ha/yr) and nitrogen (16 kg/ha/yr). These numbers include both wet, dry and cloud sources of disposition.

The evidence indicates that aquatic resources in Dolly Sods are presently under considerable stress from a combination of natural and deposition-derived acidity. Precipitation acidity, and concentrations of acidifying substances, are among the highest in the nation. The water resources of the Dolly Sods Wilderness are showing signs of stresses. Most waters in the wilderness are extremely low in pH and acid neutralizing capacity, and springtime aluminum levels are above the toxicity threshold for some aquatic species, including eastern brook trout.

5.5.2.2. Air Quality

The Dolly Sods Wilderness is within a Class 1 area. There are no significant sources of pollutants in the area according to the emissions inventory contained within the State Implementation Plan developed by the West Virginia Department of Environmental Protection. The area is in attainment with the State Implementation Plan.

The analysis for visibility in the Monongahela National Forest Class 1 area is based on representative Shenandoah National Park baseline data. Visibility in Eastern Class 1 air quality areas is severely impacted. Median standard visual range (SVR) may vary from 35 to 56 km in spring months; 25 to 38 km in summer months; and 56 to 84 km in fall months. Worst visibility days have standard visual ranges that vary from 11 to 29 km in spring months; 9 to 23 km in summer months; and 12 to 33 km in fall months.

Best visibility is during fall months, and worst is in summer during peak wilderness use periods. Forest Service data shows slight increases in standard visual ranges during the 1987 to 1992 monitoring periods. Since monitoring is not designed for rigorous analysis and testing, it cannot be determined if the increases are significant changes in standard visual

ranges during the monitoring period. It is believed by the Forest Service that visibility at the Dolly Sods Wilderness has been impaired. Mean annual sulfur dioxide concentrations estimated using the Regional Atmospheric Deposition Model (RADM) may exceed 20 $\mu g/m^3$. There are no specific air quality requirements for wilderness areas which supersede other requirements related to pollution control. Protection of visibility is the guideline of concern.

An analysis of vegetation at the Dolly Sods Wilderness was performed to assess air quality. A survey of lichen floristics and lichen elemental analysis was conducted for the Dolly Sods Wilderness in 1987 and again in 1992. This survey was done by Dr. James Lawrey, professor of biology at George Mason University in Fairfax, Virginia. Dr. Lawrey is a professional lichenologist, and very familiar with the lichens and other biota of Dolly Sods. Results of the survey indicate the following: (1) lichen flora do not presently show signs of air pollution effects, either in species richness or community composition; (2) elemental analysis of lichen tissues shows that sulfur concentrations have significantly increased from 0.131% to 0.149% dry weight in the wilderness since 1987; (3) the number of sampling sites with elevated sulfur concentrations (0.20% and higher) has doubled since 1987, representing 5.6% of the 121 sites sampled; and (4) increases in lichen sulfur and nitrogen content since 1987 are believed to be due to air pollution influences, although there are no noticeable effects on the lichen flora or growth rates. These lichen survey results provide an additional piece of evidence that the acidifying elements sulfur and nitrogen are accumulating in the wilderness environment, even though they are not specifically impacting the lichen community at this time. The above information and research/survey results provide evidence of an ecosystem under stress from air pollution.

5.5.2.3. Soils

In the early 1900s the Dolly Sods area was logged. The virgin red spruce forests were cut. The thick humus top layer of soil dried out without the protective cover of trees, and sparks from logging railroads caused fires. The 2 to 4 feet of accumulated humus burned down to bare rock. As a result, the present soil is quite young, very shallow, and stony.

Rocks in Dolly Sods were formed during the Pennsylvanian and Mississippian geologic eras. The uppermost stratum is Pottsville sandstone; it contains silica embedded with white quartz pebbles. This rock forms course, sandy soil that drains easily. Many of the hiking trails are described by the Forest Service as wet and rocky. They are wet around streams and wetlands, and rocky elsewhere.

5.5.2.4. Noise

Dolly Sods Wilderness is particularly enjoyed for its quiet atmosphere. There are no continuous generators of noise present. Sources of noise include vehicles on the Forest Service road, gunshots of hunters, barks of dogs, and airplane-created sonic booms from

Department of Defense aircraft flying practice maneuvers close to the wilderness area, and in winter, the rumble of snow-making equipment near Timberline.

The West Virginia Department of Transportation measured random, off-peak hour, off-season ambient noise levels at the Dolly Sods Wilderness in September of 1992. The ambient noise level was recorded at 43dBA. This would be considered baseline (Baker, Corridor H, P III-68).

5.6. Cultural Resources

Cultural resources are buildings, sites, structures, or objects with historical, architectural, archaeological, cultural, or scientific importance.

5.6.1. Investigative Methods and Resources

Little written information is available for the area. Excellent data sources included:

- **Fred McEvoy, Archaeologist, West Virginia Historic Preservation Office**—reviewed all records in the Division of Culture and History to determine if any archaeological or architectural resources were known to exist in the area.

- **Hunter Lesser, Archaeologist, USDA Forest Service, Monongahela National Forest**—discussed known sites and provided a map locating areas. He also provided excellent strategies for mitigation techniques to limit the disturbance of artifacts during ordnance location and removal.

- **Gloria Gozdzik, Archaeologist**—provided technical evaluation and guidance for development of the Environmental Assessment.

Written information regarding artifacts found in the area is found in:

- *Feasibility Study Dolly Sods Wilderness Area: Engineering Report for Extent of OEW Contamination and Evaluation of Remedial Action Alternatives, 1992*— prepared by Metcalf & Eddy, Inc., for the U.S. Army Corps of Engineers. During the feasibility study conducted in 1991, a number of metallic artifacts were found including railroad spikes, iron bolts, axe heads, as well as camping remnants such as tent stakes and tin cans.

- *Appalachian Corridor H, Supplemental Draft Environmental Impact Statement*— contains an inventory of archaeological or architecturally significant items in the Corridor H study area. There are none within the Dolly Sods Wilderness noted in the report. According to works reviewed by the Baker firm for the Environmental Impact Statement, some evidence exists to suggest that native Americans traveled routes north of the Dolly Sods Wilderness. However, it is the opinion of Forest Service archaeologists that there has

been too little investigation of the area to confirm lack of use by native American populations.

5.6.2. Inventory of Cultural Resources

When European settlers arrived they found Dolly Sods covered by a magnificent red spruce forest. Logging operations commenced in the 1880s and lasted into the 1920s. Fires associated with lumbering and deliberate burning by farmers to create more grazing land caused the loss of the 2 to 4 feet of topsoil. In those fires, many non-metallic artifacts would probably also have been destroyed.

In 1920, the area became part of the Monongahela National Forest, managed by the USDA Forest Service. In the 1930s the Civilian Conservation Corps helped to construct the gravel road, Forest Route 75, that traverses portions of the Dolly Sods Wilderness boundary. In 1975 Dolly Sods was designated as a wilderness area by Congress.

According to the review of files at the Division of Culture and History, there are no archaeologically or historically significant sites in the Dolly Sods Wilderness. The USDA Forest Service, Monongahela National Forest, has maintained records which indicate potential sites of interest. None has been fully explored as of yet.

According to the information contained in the *Engineering Report for Extent of OEW Contamination and Evaluation of Remedial Action Alternatives* submitted in 1992 from the 1991 *Feasibility Study Dolly Sods Wilderness Area: Final Work Plan for Surface and Subsurface Investigation and On-Site Disposal of Ordnance*, there are many artifacts of the logging era, both on the surface and in the subsurface of Dolly Sods. Ordnance removal crews using hand-held magnetometers located over 25 metallic items including railroad spikes. Records of locations of these artifacts were maintained, and are presented as Figure 5-1(e). Unfortunately, because pictures and descriptions of the locations in context to the surroundings were not maintained, to a large degree the value of the information was lost.

The National Historic Preservation Act defines historic resource or historic property as: "any prehistoric or historic district, site building, structure or object included in or eligible for inclusion in the National Register (of historic places); such term includes artifacts, records, and remains which are related to such a district, site, building, structure, or object."

In the Dolly Sods Wilderness, it is anticipated that two types of cultural significance may occur. The first could be defined as those sites associated with logging activities in the area. Those logging sites with unique features are of great interest, however, most logging sites at Dolly Sods may be of a type common and numerous throughout the state. The second type of site would be those containing prehistoric materials. While no known sites have been identified, the possibility exists that they may be present, particularly in areas used as campsites. Modern man and prehistoric man required the same set of conditions—water,

level ground, protection from the elements, and consequently, sites favored by modern campers may have been used by prehistoric campers as well.

5.7. Socioeconomic Resources

5.7.1. Investigative Methods and Resources

Socioeconomic investigations conducted for preparation of this environmental assessment consisted of a review of existing literature and data sources and interviews with specialists from the Potomac Ranger District, USDA Forest Service.

Various reports and data sources were reviewed, including:

- *West Virginia Area III Partnership for Progress Travel and Tourism Economic Impacts-1991*—This report was prepared by Gordon W. McClung, Ph.D., associate professor of marketing at West Virginia University, and Rebecca L. Suter, MBA, business research analyst at West Virginia University. This report presents a summary of economic impacts of the travel and tourism industry for the Area III Partnership for Progress region, which includes the Dolly Sods Wilderness. These analyses are based on the 1982 West Virginia Input-Output Model (WVIOM).

- *West Virginia Travel and Tourism Economic Impacts 1992*—This report was prepared by Gordon W. McClung, Ph.D., associate professor of marketing at West Virginia University, and Rebecca L. Suter, MBA, business research analyst at West Virginia University. This report gives summary information on the economic impacts of the travel and tourism industry in West Virginia, based on the WVIOM (revised 1992).

- *West Virginia Area III Partnership for Progress Travel and Tourism Economic Impacts-1992*—This report was prepared by Gordon W. McClung, Ph.D., associate professor of marketing at West Virginia University, and Rebecca L. Suter, MBA, business research analyst at West Virginia University. This report presents a summary of economic impacts of the travel and tourism industry for the Area III Partnership for Progress region, which includes the Dolly Sods Wilderness. These analyses are based on the 1982 WVIOM (revised 1992).

- *West Virginia Business and Economic Review* (WVBER), Winter 1988 and Spring 1988 editions. This newsletter is a quarterly publication of the Center of Economic Research in the College of Business and Economics at West Virginia University. The WVBER contains articles relevant to the West Virginia economy. The Winter and Spring 1988 issues discuss the methodology and implications of the 1982 West Virginia Input-Output Model.

Figure 5-3. Most hiking in the Dolly Sods Wilderness is on the Laneville segment of the Red Creek trail.

- *Regional Economic Information System* (REIS), Bureau of Economic Analysis, U.S. Department of Commerce, Washington, DC. The REIS is an annual CD-ROM produced by the Bureau of Economic Analysis. The information extracted from the CD for this analysis was from the BEARFACTS fact sheets and Table CA05, "Personal Income by Major Source and Earnings by Detailed Industry."

- *Finding and Using Economic Information: A Guide to Sources and Interpretation*, written by David B. Johnson. This guide contains comprehensive information on economic data sources and issues.

- *West Virginia Economic Summary: A Monthly Newsletter on Economic Activity in West Virginia*, June 1995. This newsletter is published by the West Virginia Bureau of Employment Programs, Labor and Economic Research Division.

- *Standard Industrial Classification* (SIC) *Manual*, 1987. This manual classifies each industry by a four-digit SIC code number.

In addition to reviewing the literature above, telephone interviews were conducted with Nancy Feakes and Dave McMorran.

5.7.2. Inventory of Socioeconomic Resources

For the purpose of this study, socioeconomic data were used from the four-county (Grant, Pendleton, Randolph and Tucker) region contiguous to the Dolly Sods Wilderness.

Based on existing data and telephone interviews with Dave McMorran, assistant ranger, Potomac District, it is estimated that approximately 45,000 to 75,000 people visit the Dolly Sods Wilderness annually. Most of these visits occur during weekends and on holidays from Memorial Day through Labor Day. It is estimated that 20,000 to 25,000 visit the Dolly Sods Wilderness for the "wilderness experience." Information about the duration of the average visit or the use of hiking trails was not available from the Potomac District. It has been observed that the majority of visitors do not stray far from Forest Road 75 which skirts the eastern boundary of the wilderness area. However, there are many hikers/backpackers who spend several days in the wilderness area hiking the trails and camping. Visitors come from throughout the United States, with the majority from the mid-Atlantic region. It is estimated that 500,000 users use the National Recreation Areas in the four-county area surrounding Dolly Sods. The National Recreation Area includes Seneca Rocks, Smoke Hole, and Spruce Knob.

Data from the Bureau of Employment Programs and the Bureau of Economic Analysis indicate that the four-county area surrounding Dolly Sods has a civilian labor force of 25,190 with an unemployment rate of 9.2 percent compared with West Virginia, which has 782,700 and 7.5 percent, respectively. The total employment for the four-county area is 26,810. Employment in industries which include tourism (i.e. Transportation and Public Utilities, Retail Trade, and Services) is 11,863. Earnings in industries which include tourism (i.e. local and interurban passenger transit; transportation by air; general merchandise stores; automotive dealers and service stations; apparel and accessory stores; eating and drinking places; miscellaneous retail; hotels and other lodging places; auto repair, services, and garages; and amusement and recreation services) is $45.198 million.

When tourism declines in a particular area, that area suffers both direct and indirect economic consequences, or impacts. According to the *West Virginia Travel and Tourism Economic Impacts 1992*, direct impacts are defined as "the initial value of goods and services purchased by travelers. These include the revenues generated by businesses such as hotels, restaurants, amusement parks, etc. that directly supply goods and services to travelers at the retail level. This publication then defines indirect impacts as "the purchase of goods and services by businesses for operating needs. These purchases generate additional output or sales indirectly

when the supplying businesses in turn purchase goods and services from their suppliers. This chain of transactions occurs until the initial purchase totally 'leaks' out of the state by businesses dealing with out-of-state suppliers." Therefore, the total economic impact of a decline in tourism within an area is the "sum of the direct and indirect impacts." The ratio of direct impacts to total impacts is usually referred to as the multiplier.

Research conducted by McClung and Suter showed that the total economic impacts of tourism in 1992 of the Partnership for Progress Area III were: $76.7 million in output; 1,705 jobs; and, $28.9 million in payroll. These economic impacts were for the 10 counties within the Partnership for Progress Area III. The counties are Braxton, Webster, Pocahontas, Randolph, Pendleton, Tucker, Grant, Hardy, Mineral, and Hampshire. The economic impacts of the Partnership for Progress Area III will be deflated to obtain an upper bound estimate of the impact of the different alternatives. These are presented in sections 6.2.1.7, 6.3.1.7, and 6.4.1.7 of this report.

6.0. ENVIRONMENTAL CONSEQUENCES

This section of the Environmental Assessment forms the scientific and analytic basis for the comparison of alternatives. It includes a discussion of significant impacts of the alternatives; any adverse environmental effects that cannot be avoided should the project be implemented; the relationship between short-term use of man's environment and the maintenance of long-term productivity; and any irreversible commitment of resources and means to mitigate adverse impacts.

6.1. Applicable Regulations

To determine the applicability of federal and state regulations for the ordnance removal project, a preliminary review of regulations was performed, as presented in Table 6-1. Based on that analysis of applicability, regulations were reviewed in detail to conform to guidelines for compliance requirements. All aspects of the ordnance removal project are in full compliance with applicable federal and state regulations.

6.1.1. Archaeologic, Historic, and Scientific Preservation

Under the Archaeological and Historic Preservation Act of 1974, the Department of the Interior establishes procedures for preservation of historic and archaeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program (16 U.S.C. §469). The Dolly Sods Wilderness contains sites which hold remnants of logging activities which occurred in the early 1900s. Therefore, steps will be written into the work plan for remediation which will preserve the archaeological value, if any, of these sites. These steps are described in section 6.2.1.6.

6.1.2. Endangered Species Act (16 U.S.C. §1531 et seq.)

The endangered species act requires actions to be taken that will conserve identified local endangered or threatened species of fish, wildlife, and plants.

The term "critical habitat" is defined at 16 U.S.C. §1532(5(A)) as:

(i) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of Section 4 of this Act, on which are those physical or biological features (1) essential to the conservation of the species and (2) that may require special management considerations or protection; and

Table 6-1
Preliminary Screening for Determining the Applicability of Related Federal Environmental Statutes and Regulations

Question	Regulation	Affect
1. Are there potentially any threatened or endangered species or their critical habitats in the area of the proposed action?	Endangered Species Act	yes
2. Would the proposed action be located within a floodplain or in a wetland area?	Floodplain/Wetlands Regulations	yes
3. Would the proposed action modify or impact a waterway?	Fish and Wildlife Coordination Act	no
4. Would the proposed action involve a coastal zone?	Coastal Zone Management Act	no
5. Would the proposed action affect prime or unique farmlands?	Farmland Protection Policy Act	no
6. Are there any historic sites in the area of the proposed action?	National Historic Preservation Act	none documented but several suspected
7. Would the proposed action interfere with the right of Native Americans to exercise their traditional religions?	American Indian Religious Freedom Act	no
8. Would the proposed action involve waterways designated as wild and scenic rivers?	Wild and Scenic Rivers Act	yes
9. Is the proposed action a Resource Conservation and Recovery Act (RCRA) corrective action or a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedial action?	Resource Conservation and Recovery Act/ Comprehensive Environmental Response, Compensation, and Liability Act	no; none designated but one eligible
10. Are there any cultural resource sites in the area?	National Historic Preservation Act	no

(ii) Specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of Section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species.

Under Section 7(a), federal agencies must consult with the Department of the Interior, and the USDA Fish and Wildlife Service. For marine species, federal agencies must also consult with the National Marine Fisheries Service to ensure that remedial actions do not jeopardize

the continued existence of endangered or threatened species, or adversely modify or destroy their critical habitat.

It is known that the Cheat Mountain salamander exists within the Dolly Sods area. As a result, the Forest Service and the Fish and Wildlife Service requested that a biological assessment of the impact of ordnance removal be conducted. This assessment is included in Appendix IV. It is the opinion of recognized experts that an "incidental taking" may result from project activities. While proposed work will not directly harm the species nor should it do long-term damage to its habitat, efforts have been coordinated with the Forest Service and the Fish and Wildlife Service to ensure that remedial activities will not harm this species or other endangered species which may be present in the Dolly Sods Wilderness.

6.1.3. Fish and Wildlife Coordination Act (16 U.S.C. §661 et seq.)

The Fish and Wildlife Coordination Act requires that actions be taken to protect fish and wildlife that may be impacted by diversion, channeling, or other activities that modify a river or stream (16 U.S.C. 662). Specifically, the FWCA, along with the Conservation Act and other advisories, requires federal agencies issuing a permit to modify any off-site body of water to consult with federal and state wildlife agencies to ensure that resources are appropriately protected. Consultation is strongly recommended for on-site remedial activities. Coordination with a number of state and federal agencies would be necessary for those alternatives which may impact area water bodies to prevent, mitigate, or compensate for project-related losses of fish or wildlife.

All planned project activities are unlikely to significantly impact fish or wildlife populations.

6.1.4. 40 CFR Part 6, Appendix A

EPA policy for carrying out the provisions of Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands) are set forth in 40 CFR Part 6, Appendix A. These policies are discussed below.

- **Floodplain Management.** Executive Order 11988 directs federal agencies to avoid long- and short-term adverse impacts associated with occupancy and modification of floodplains. Agencies responsible for providing federal assistance for construction and improvements and for conducting programs affecting land use must take actions to accomplish the following:

  - Reduce the risk of flood loss;

  - Minimize the impacts of floods on human safety, health and welfare; and,

  - Restore and preserve the natural and beneficial values served by floodplains.

These requirements could be potentially applicable if federal funds are used (e.g., federal lead on remedial actions or mixed funding).

Most of the requirements associated with the order are set forth in the Floodplain Management Guideline, published February 10, 1978, by the Water Resource Council to aid federal agencies in complying with the order. These guidelines include alternative evaluation, impact assessment and mitigation, and public involvement that are already incorporated into the feasibility study process.

- **Protection of Wetlands.** Executive Order 11990 directs federal agencies to take actions to minimize the destruction, loss, or degradation of wetlands. To preserve and enhance the natural and beneficial values of remediation, potential wetlands in the area must be evaluated. Wetland protection requirements include assessing the impacts of any proposed actions on the wetlands, evaluating alternatives and their potential effects on the wetlands, and identifying mitigative measures to minimize potential harm to the wetlands. These requirements are included within the Forest Service process and therefore do not result in any additional requirements.

  Wetlands are defined as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and 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." (33 CFR §323.2(c)).

At Dolly Sods, there are wetlands which will be under investigation. The wilderness area status of the site goes beyond the requirements of this regulation in protecting these areas.

6.1.5. The Wilderness Act

The Wilderness Act was passed in 1964 in order to "secure for the American people of present and future generations the benefits of an enduring resource of wilderness." The act establishes a national Wilderness Preservation System consisting of wilderness areas such as Dolly Sods. The act states that this system will "be administered for the use and enjoyment of the American people in such a manner as will leave [the wilderness areas] unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas [and] the preservation of their wilderness character."

In the Wilderness Act, limitations are placed upon the activities which may be allowed inside the wilderness areas. Each of the agencies administering wilderness areas is responsible "for preserving the wilderness character of the area." The agencies are further directed to administer the wilderness areas so as to "preserve its wilderness character." Temporary roads, motorized vehicles or equipment, landing of aircraft, and structures or installations are not allowed in any wilderness areas. The exceptions to these restrictions are allowed "as

necessary to meet minimum requirements for the administration of the area for the purpose of [the Wilderness] Act (including measures required in emergencies involving the health and safety of persons within the area)."

The project plan has been fashioned to take special consideration of the Wilderness Act. The overriding goal is to "leave no trace." However, the removal of ordnance contamination is of great importance and is necessary to the administration of the area. In addition, damage to the environment will be short-term. The wilderness area status of the site will continue to place limits upon activities which can be performed at the site, and all activities performed during remediation, in particular those which are not typically allowed in Dolly Sods, will be carefully coordinated with the Forest Service.

6.1.6. The National Environmental Policy Act

The National Environmental Policy Act of 1969 (NEPA), signed into law on January 1, 1970, established a national policy to strive for beneficial use and improvement of the environment without degradation. The act set forth a comprehensive federal environmental policy and a process for environmental review of all major federal actions in light of environmental goals and needs. Section 102C of the act calls for the preparation of a detailed Environmental Impact Statement (EIS) as a major part of this process whenever it is determined that the action has a potential to cause significant adverse impact on the quality of the human environment. In 1978, the Council on Environmental Quality (CEQ) adopted regulations (40 CFR 1500-108) to strengthen and focus the NEPA/EIS process. The emphasis of the CEQ regulations is to establish uniform procedures for the implementation of NEPA, to reduce paperwork, to minimize delays, and to improve decision-making. Section 1507.3 requires each federal agency to adopt procedures to implement NEPA in accordance with the requirements of the regulations.

The overall objective of the NEPA process is to ensure that adequate consideration is given to environmental factors in carrying out federal actions. The elements of the process include consideration of these factors early in the planning effort, use of a systematic interdisciplinary approach to environmental analyses, development and evaluation of alternatives to ensure mitigation of adverse impacts, and involvement of the public, as well as governmental officials, in the review and decision-making process.

6.2. Alternative 1—Removal of Ordnance From Trails and Campsites

There are 101 campsites and 20.8 miles of trails that encompass 105 acres in the Dolly Sods Wilderness. Trails will be searched their entire length and 20 feet to each side by UXO specialists using hand-held detection devices such as metal detectors. The surface visual sweeps and subsurface electromagnetic sweeps will be conducted leaving vegetation intact where possible. If metal is indicated, the site will be excavated following procedures described in section 4.1.2. Issues such as the presence of threatened or endangered species

or digging on steep slopes will be addressed by following mitigation plans and, as necessary, review on a case-by-case basis by the on-site Forest Service official.

The area along trails will be excavated by hand to a depth of 1 foot. If materials other than ordnance are found, location will be noted, and a photo taken showing the item in context with its surroundings. The item will be returned to the hole, then the hole will be filled using excavated material, and hand tamped.

If ordnance is found, it will be detonated in place. The Forest Service official will determine the level and type of remediation necessary. It could range from no action, should the site be rocky and the disturbance minimal, to importing fill from a borrow source, reseeding with Allegheny flyback or crinkle grass, and impeding erosion through placement of mulch or other ground cover.

Campsites will also be searched, using the methodology described above. Metal will be excavated to a depth of up to 4 feet. The total area to be remediated is 105 acres (103.8 acres along trails and 1.5 acres of campsites).

A summary of environmental consequences is found in Table 6-2.

6.2.1. Direct and Indirect Effects and Their Significance; Mitigation Measures

The impact on the Dolly Sods Wilderness will be created by three activities: disturbance of trails and campsites during the search for ordnance; excavation to determine the presence of ordnance; and detonation.

An excellent measure of the probable impact of these activities is to review the impacts from an actual project of the same type: the feasibility study conducted at the Dolly Sods Wilderness in 1991. Two hundred eighty-one acres were disturbed; 147 holes were dug; and 13 pieces of ordnance were detonated in place. According to Jim Page, forest supervisor of the Monongahela National Forest, although no formal impact analysis was conducted, it appears that there were no significant impacts to the wilderness area. Two Forest Service employees observed some of the detonations of mortar rounds occurring during the 1991 feasibility study and later. Extracted information concerning their observations of the detonations and some of the affected areas in 1995 is presented as Exhibit 6-1. The complete documents of these events are included in Appendix II.

It follows that, since the 1991 project affected area is nearly three times the proposed project area, the impact of the proposed project should be the same or less than the 1991 project.

Table 6-2
Summary of Environmental Consequences
Alternative 1—Removal of Ordnance From Trails and Campsites

Resource	Action and Effect	Mitigation Measures
Botanical	Walk through 105 acres; disturb up to 570 sq. ft. of vegetation through excavation and detonation; vegetation will return within 1 year. No brush cutting except to access ordnance. No significant impact. Project will include documentation of locations of sensitive and rare species. This will contribute to scientific database, a positive impact.	Document location and transplant sensitive species to suitable habitat or reseed as appropriate. Species will be appropriate for site.
Zoological/Wildlife	Walk through 105 acres; mobile species will move during project, then return. Immobile species may suffer incidental taking. No short-term or long-term effect on wildlife. Project will include documentation of locations of endangered, threatened, and sensitive species. This will contribute to scientific database, a positive impact.	Document location of endangered, threatened, and sensitive species. Collect and hold Cheat Mountain salamander prior to excavation and detonation, then replace. During detonation of ordnance, if found in the habitat of the Virginia northern flying squirrel, noise-deadening techniques will be used.
Wilderness	Walk through 105 acres; disturb up to 570 sq. ft. of vegetation. No visual impact. Use of limited areas in the wilderness for recreation will be limited for up to 6 months during ordnance removal. Long-term public safety will be improved. Also, an evidence of human use (ordnance) will be removed. This will be a positive impact. New topographic maps will be created by the Corps of Engineers based on detailed aerial photography of the wilderness. These maps will be available to wilderness managers and users; a positive impact.	Disturbed areas will be remediated for esthetics. Visitors to Dolly Sods Wilderness will be provided with information regarding alternative use areas.
Wetlands	No waterways will be altered. Ordnance found and detonated in wetlands will cause craters to be formed; original configuration will return within 2 years.	Ordnance found in waterways will be removed then detonated.

Table 6-2
Summary of Environmental Consequences
Alternative 1—Removal of Ordnance From Trails and Campsites
(Continued)

Resource	Action and Effect	Mitigation Measures
Environmental air/water/soils/noise	No air emissions. No aqueous or solid waste emissions. If ordnance is located in waterway, it will be moved and detonated away from stream. Noise (between 5 and 30 detonations of ordnance) may be heard. All equipment is noise-free, so no contribution to ambient noise will be made. No significant impact.	Soil erosion and stream sedimentation will be controlled through proven techniques. Noise will be dampened by covering ordnance with sandbags.
Cultural	Project will include survey to document locations of cultural resources. Survey will contribute to archaeological database, a positive impact.	Archaeologist to conduct complete literature review of historic logging activities and develop comparative file to evaluate potential significance of historic remains; on-site investigation by trained archaeologist to identify cultural remains as necessary.
Socioeconomic	Use levels of the Dolly Sods Wilderness may decline for up to 6 months, during ordnance removal. However, UXO work crews will contribute to area economy. No net impact in the near-term. Long-term impact is positive. Maintenance of trails and campsites can be conducted without first searching for ordnance. Funds can be allocated directly for maintenance rather than for ordnance searches.	UXO teams will work in isolated areas and will limit access to one area at a time. Other areas will remain open to users.
Public Safety	A corridor of safe and useable areas will be created. Safety for users will be enhanced, as most users stay on trails and in campsite areas; a positive impact. However, risk remains for those who leave trails and campsites, such as hunters. High risk will remain in the event of a forest fire.	Fire control will be implemented by UXO crews and Forest Service employees. Caution signs will be posted to warn of danger in areas outside of trails and campsites.

Exhibit 6-1
Observations on the environmental impact during and after detonation of ordnance.

Jim Page, Forest Supervisor
USDA Forest Service
Monongahela National Forest
June 7, 1995

We did not conduct a formal analysis of the impacts from the work performed in the 1991 Feasibility Study. There were minor impacts and disturbances to the vegetation and soils observed in 1991, and we are in the process of photographing some of those disturbance areas this week. Monica Gallion and Jill Shoemaker, two of our forestry technicians who have worked in the Dolly Sods area, observed several mortars being exploded in the 1991 study and since. They reported that, for the most part, the ordnance was moved to rocky areas with little vegetation before it was exploded and that the environmental damage occurring was "negligible" - in some cases hardly noticeable. In at least one instance when the partially exposed ordnance was detonated in place, (with explosives and cover being placed on top of it), the resulting 1 - 1 1/2-foot-deep hole was filled with rocks and soil, and plant litter was placed on top of it so that it was less noticeable.

In many of the areas where the digging of metal will take place, the soil profile was disturbed and/or overturned by explosions of ordnance during the training exercises fifty years ago. Additional disturbance by digging to identify and recover the metal objects located during this operation will not be significant, if steps are taken to prevent erosion and protect aesthetic values. This project will disturb well under 1 percent of the acreage in the Wilderness.

Jill Shoemaker, Forestry Technician
USDA Forest Service
Monongahela National Forest
June 7, 1995

On June 7, 1995 I hiked along the Red Creek corridor in an attempt to observe the natural revegetation of sites where UXO had been found and dug out of the ground in the 1991 feasibility study conducted by a contractor for the U.S. Army Corps of Engineers. I was also looking for sites where one or more of the ordnance had been detonated. I did a visual survey of the area identified as "Area A" in the feasibility study report prepared by Metcalf & Eddy, Inc. in 1992. The report stated that UXO was found in this area which is the floodplain of Red Creek bordered on both sides by steep slopes. I saw no obvious signs of UXO removal from the ground or detonation of UXO. The understory is grass and rhododendron and the ground is somewhat rocky. The forest is rather open in this area. Portions of a turn of the century railroad grade are visible where flood waters have not destroyed it.

I located a site along the Red Creek corridor where one mortar round was located by visitors in August, 1994 and then detonated by U.S. Army personnel in September, 1994. I was present at the detonation. The ordnance was partially buried therefore the Army personnel decided not to move it to another location to detonation and also decided to blow it into the ground rather than upward. This area was located in the floodplain where only very high water channels dissect the plain. The ground was covered with a thin layer of soil with rocks protruding throughout. The ordnance was buried in rock and soil.

Exhibit 6-1
Observations on the environmental impact during and after detonation of ordnance.
(Continued)

After the explosion a sulphur scented smoke hung in the air for several minutes. The loud sound of the explosion only lasted a second or two. I did not observe any impact to the water quality of Red Creek which was approximately 100 feet away. My only observation of wildlife at the time was pause in the bird songs which resumed several minutes after the detonation. A hole approximately 18 inches deep by 5 feet long by 4 feet wide was left by the detonation. We filled this with the rock fragments (approx. the size of two softballs) that had been broken by the explosion. Some tree roots (approx. <1-inch in diameter) were exposed and they extend out over the crater.

I observed this same site on June 7, 1995 and found the hole to be filled with leaf litter so that the depth was no greater than 1 foot at any point. The crater was still 5 feet long by 4 feet wide. The exposed roots were no longer functional but the two birch trees (approx. 4 inches in diameter) had green leaves and appeared to be healthy. I saw no signs of erosion immediately surrounding the crater. Because of the rocky and uneven ground in this area the hole left by the detonation that occurred nine months ago is relatively unnoticeable by the average visitor. The turn-of-the-century logging and frequent flooding of Red Creek have left depressions and gullies throughout the Red Creek corridor. I am defining the Red Creek corridor as the land that lays between the steep-sided walls of the mountains on both sides of the creek.

I have also observed ordnance detonation on the grassy plains of the Dolly Sods Scenic Area located north and east of the Dolly Sods Wilderness. The holes left by these explosions are not as deep or long as the one previously discussed. The ordnance was placed on rocks which were fragmented by the explosion. I do not feel that the UXO detonations I have witnessed have had significant impacts on the resources of the Wilderness or Scenic Area.

6.2.1.1. Botanical Resources

The work plan calls for cutting no vegetation, unless necessary to access a piece of ordnance. The impact, then, would be a result of the disturbance of 105 acres, of excavating up to 201 holes, and detonation of between 5 and 30 pieces of ordnance. Potentially, up to 570 square feet of vegetation could be disturbed from excavation and detonation activities. Minor impacts to vegetation in the 1991 feasibility study were due to walking on the surface.

Botanical field surveys indicate the presence of many interesting plant communities within the wilderness area including:

- cranberry-beakrush-sedge bogs;
- blueberry-huckleberry heath communities;
- grass balds;
- quaking aspen groves; and
- windswept red spruce communities.

According to published data, there are no botanical endangered species, however, there are 41 species in the general federal category which includes endangered, threatened and sensitive; and 378 species listed in the rare category by the West Virginia Department of Natural Resources.

Special attention has been assigned to measuring the impact on endangered, threatened, and sensitive species, and on rare species. To identify impacts to these sensitive botanical populations, the probability of occurrence and impact are addressed for each species of concern in Appendix III. Also included is a plan for mitigation of impact. The mitigation plan includes procedures which will be incorporated into the UXO crew's work plan. As a result, the ordnance removal project will have no significant impact on botanical species at the Dolly Sods Wilderness.

All endangered, threatened, sensitive and rare plants known or thought to occur in the Monongahela National Forest are listed in Appendix III. Thirty-seven of these plant species are felt to have a significantly high chance or are known to occur in the Dolly Sods Wilderness. All plants were categorized by "impact" and "occurrence".

Probable Impact of Ordnance Removal alternatives were categorized as follows:

- 1. **Major**—Potential major negative impacts are likely to occur because these plants are fragile, have shallow fibrous root systems, grow in wet or loose soils, and basically are herbs, forbs, ferns, or sedges.

- 2. **Considerable**—Potential exists for substantial damage to 33% or more of a plant population in an affected area.

- 3. **Minor**—Potential exists for substantial damage to occur to less than 33% of the plant population. Many of these plants are perennials or have well-developed root systems.

- 4. **None**—This category contains plants where insignificant damage is likely to occur or it is "very unlikely" that this plant species grows in the Dolly Sods Wilderness.

Likelihood of Occurrence is classified into four categories:

- 1. **Present**—This species is know to occur in the Dolly Sods Wilderness.

- 2. **Probable**—This species has a high probability of occurring in the ordnance removal area or is known to exist in similar sites in Canaan Valley or at other locations on or near Dolly Sods.

- 3. **Possible**—This species has a greater than 33% chance of occurring in the Dolly Sods Wilderness. The species is known to occur in similar habitat conditions and/or relatively nearby locations.

- 4. **Doubtful**—It is unlikely this species exists in the Dolly Sods Wilderness.

- 5. **Very Unlikely**—This species category indicates plants that probably do not occur in the Dolly Sods Wilderness because of habitat requirements and known geographic ranges.

Seven species on the "rare" list are known to grow in the Dolly Sods Wilderness. Thirty species were assigned the "probable" rating of occurring in the Dolly Sods Wilderness. Efforts should be made to eliminate impacts to or provide maximum protection for these species during any ordnance removal. Thirty-one of these 37 species are estimated to potentially be negatively impacted in either a "major" or "considerable" way if ordnance removal is completed on sites where these plant populations occur.

The running buffalo clover is the only endangered species with a "possible" rating. The plant has not been found in the Dolly Sods Wilderness, however, it grows in moist, wooded areas in disturbed soils around Parsons, West Virginia, 15 miles from Dolly Sods. Some Dolly Sods Wilderness habitats would support running buffalo clover. It is anticipated that ordnance removal would not impact running buffalo clover populations. In fact, by disturbing soils, the removal action would have a positive impact on the running buffalo clover by creating disturbed soils.

Thirty of the 37 "present" or "probable" species occur in bogs, swamps, or wetland soils. These soils are subject to minor erosion but would be very subject to displacement and cratering should any underground ordnance be exploded without a mat to hold the soil in place. Most of these plants are characterized by having shallow, fibrous root systems. Entire plants or clumps of grasses and sedges could be easily blown away. Ordnance removal in late summer or fall will provide plants a greater opportunity to produce seeds and be correctly identified.

Two of the 37 "present" or "probable" species (fly honeysuckle and balsam poplar) are perennials and would likely sustain only minor damage during ordnance removal because they occur in moist woods where other roots would absorb considerable force.

Five of the 37 "present" or "probable" species occur in dry, rocky habitats. These species are white alumroot, heart-leaved paper birch, paper birch, purple virgin's bower, and three-toothed cinquefoil. Only the purple virgin's bower and three-toothed cinquefoil are likely to sustain major damage, because of long vining branches and relatively shallow root systems, respectively.

Six of the 37 "present" or "probable" species are trees or shrubs. These should maintain less damage than most herbs, grasses, sedges or rushes.

It should be recognized that many of the plants that are listed as "present", "probable", or "possible" (the three most likely categories to occur in the Dolly Sods Wilderness) will be difficult, and probably impossible, for anyone other than a professional botanist to correctly identify. Thirteen of the plants are grasses, sedges or rushes which may only be identified during a short period of the growing season when flowers and/or seeds are present. Some of these plants, such as the running buffalo clover, have not been found in the Dolly Sods Wilderness. This situation strongly dictates a process as follows:

- Step 1— Locate any ordnance;
- Step 2— Have a professional botanist, wildlife biologist, etc., check the site for biotic element presence; then
- Step 3— Explode the ordnance.

Short-term effects on most of the plants could be negative. However, most of the "present" and "probable" plants produce good to abundant crops of seeds most years. If ordnance removal occurs late in the year, the plants will have had a chance to produce seed prior to any disturbances. Most of the biological characteristics of these plants are relatively unknown but it is speculated they do have some seeds stored in the "seed bank" of the litter and upper layer of soil.

Five of the plants probably do not meet these characteristics and should receive more careful attention. They are grass pink orchid, goldthread, rose pogonia, swamp saxifrage, and oceanurus. Long-term prospects for all but the previously mentioned five plants should be at least equal to their present status.

Because of the presence of sensitive biological resources occurring within the Dolly Sods Wilderness, specific mitigation plans have been developed to reduce impacts. There are no endangered species known to be present, however, due to the varying ecology within the wilderness area, there are varying types and degrees of mitigation techniques required. Appropriate mitigation techniques that will be employed include:

- A review of the work plan with the Potomac District Ranger or her designee. This will allow issues of concern to be raised and addressed so that proper planning can occur.

- Following metal detection and prior to excavation, photos of the area will be taken to document botanical species. This data will be forwarded to Department of Natural Resources and Forest Service botanists at the conclusion of the project.

- Prior to detonation of ordnance, the area will be surveyed for threatened and endangered species by a qualified biologist.

- Following detonation of ordnance, the Forest Service's on-site employee will determine if the crater area requires remediation. Generally, based on experiences from the 1991 feasibility study, it appears that no crater will be apparent due to the rocky nature of the land. However, should a crater need to be filled, soil will be taken from the surrounding borrow area. In order to maintain the ecological integrity, the soil from the borrow area will be matched for pH and soil type of the disturbed area. The borrow area will be within a 100-foot radius of the impact area and contain no endangered, threatened, or sensitive species. The soil will be reseeded with a native species, such as Allegheny flyback or crinkle grass, as appropriate. Erosion will be controlled with appropriate measures.

6.2.1.2. Zoological/Wildlife Resources

The approach to identifying impacts to zoological populations and to developing effective mitigation plans was to conduct a formal biological assessment. This best quantifies impact, and is appropriate as the project may lead to an incidental taking of a threatened species, the Cheat Mountain salamander. Dr. Tom Pauley, a recognized expert on Cheat Mountain salamanders, performed the assessment. Results of that assessment are presented in Appendix IV; the impact on each species of concern is addressed. It is concluded that, due to the inclusion of good, workable mitigation plans, there will be no significant impact on any zoological populations resulting from ordnance removal.

Because of the presence of sensitive zoological resources occurring within the Dolly Sods Wilderness, specific mitigation plans have been developed to reduce impacts. Due to the varying ecology within the wilderness area, varying types and degrees of mitigation techniques are required. A Forest Service official will be present on-site to help determine appropriate mitigation techniques that include:

- A review of the work plan each week with the Potomac District Ranger or her designee. This will allow issues of concern to be raised and addressed so that proper planning can occur.

- Following metal detection and prior to excavation, a walk-through inspection of the area by a qualified biologist to identify the presence of any species of concern. The organism will be moved, if appropriate and possible.

- The walk-through will be conducted at night, as the salamanders are nocturnal. If salamanders are found within 40 feet of excavation, they will be removed and stored in a jar. Prior to excavation, leaf litter and top soil will be carefully removed and preserved. Following excavation, and detonation (if required), the top soil, leaf litter,

Figure 6-1. The Dolly Sods Wilderness is a popular hunting area. UXO technicians will attempt to complete work prior to deer hunting season.

and any salamanders will be returned to the original area where they were found. By following this routine, there will be no cumulative effects on the salamander population.

Detailed procedures have been developed to reduce the impact of excavation and detonation of ordnance on zoological species. The procedures are outlined in the biological assessment, included in Appendix IV, and will be included in the UXO technicians' work plan, as presented in Section 4.1.2.

To avoid impacts to the Cheat Mountain salamander, prior to excavation, leaf litter and topsoil will be collected and saved for replacement after excavation. Any reptiles or amphibians found prior to excavation will be contained and subsequently released to the place

originally found. This will cause no significant impact on the Cheat Mountain salamander population.

To avoid impacts to the Virginia northern flying squirrel, special detonation techniques will be used in areas of potential habitat. The techniques include sandbag covers to reduce noise and flying shrapnel. As a result, there will be no significant impact on the Virginia northern flying squirrel.

The endangered, threatened, and sensitive zoological species with a possible likelihood of occurrence in the Dolly Sods Wilderness are listed in Appendix IV. An evaluation of the effect of Alternative 1, removal of ordnance from trails and campsites, is presented in Table 6-3.

In a telephone conversation with the president of the Brooks Bird Club, Mr. LeJay Graffious, the Biological Evaluation was discussed. He concurred with locations of birds, as well as potential effects presented in Table 6-3. It was recommended that noise dampening techniques be used when ordnance is detonated so as to reduce impact on birds migrating in spring and fall, and nesting during summer months.

Table 6-3
Evaluation of Impact of Alternative 1 on Endangered, Threatened, and Sensitive Zoological Species

Common Name	Scientific Name	Impact of Alternative 1
ENDANGERED AND THREATENED		
Gray Wolf	*Canis lupus*	Since the gray wolf no longer occurs in West Virginia, no direct, indirect, or cumulative effects are anticipated from Alternative 1. The size of this project area is large enough to support the gray wolf in the event of a future reintroduction program. However, there are no plans for reintroduction of the gray wolf into West Virginia.
Eastern Cougar	*Felis concolor couguar*	Although this project area is large enough to support the cougar, Alternative 1 is very limited in area and would not create an irretrievable loss of potential habitat.
Virginia Big-Eared Bat	*Plecotus townsendii virginianus*	There are no records of occurrence or suitable potential habitat of the Virginia big-eared bat in the project area. As a result, direct, indirect, or cumulative effects are not anticipated on the Virginia big-eared bat from Alternative 1.
Indiana Bat	*Myotis sodalis*	There are no records of occurrence or suitable potential habitat of the Indiana bat in the project area, therefore, no direct, indirect, or cumulative effects are anticipated on the Indiana bat from Alternative 1.

Table 6-3
Evaluation of Impact of Alternative 1 on
Endangered, Threatened, and Sensitive Zoological Species
(Continued)

Common Name	Scientific Name	Impact of Alternative 1
ENDANGERED AND THREATENED (Continued)		
Peregrine Falcon	*Falco peregrinus*	Peregrine falcons have not been observed in the project area, but the Red Creek canyon does have potential habitat. Detonation of ordnance in the area of a nest could have a negative impact on nesting birds. Before detonation, all sites should be examined for nests by a qualified biologist. If nests are not present, no direct, indirect, or cumulative effects are anticipated in Alternative 1.
Virginia Northern Flying Squirrel	*Glaucomys sabrinus fuscus*	There is one known population of the Virginia northern flying squirrel in the project area (Figure 5-1(c)). This population is near the northwest corner of the Dolly Sods Wilderness. Other sites within the project area could have suitable habitat (i.e., large red spruce trees). In all potential habitat where ordnance must be detonated, UXO crews should use noise-deadening techniques (i.e., sand bags). This should reduce the disturbances to the Virginia northern flying squirrel and as a result, no cumulative effects are anticipated from Alternative 1. To avoid disturbing the Virginia northern flying squirrel, April and May have been suggested as the best times to detonate ordnance.
Bald Eagle	*Haliaeetus leucocephalus*	There are no historical records of nest sites in the Dolly Sods Wilderness. Bald eagles are rare in West Virginia with most sightings reported during migration. Possible migration over the project area could occur. However, there are no large bodies of water in the project area which would provide suitable feeding and nesting sites. No direct, indirect, or cumulative effects would be expected on the bald eagle from Alternative 1.

Table 6-3
Evaluation of Impact of Alternative 1 on
Endangered, Threatened, and Sensitive Zoological Species
(Continued)

Common Name	Scientific Name	Impact of Alternative 1
ENDANGERED AND THREATENED (Continued)		
Cheat Mountain Salamander	*Plethodon nettingi*	If ordnance must be removed or detonated, digging holes, and detonation of ordnance could directly affect the Cheat Mountain salamander. However, specific procedures have been designed to minimize potential impact on the Cheat Mountain salamander. Prior to any excavation, a qualified biologist will assess the site for potential Cheat Mountain salamander habitat. The area to be surveyed will include the estimated size of the crater plus an area of 40 foot radius. Unexploded ordnance (UXO) crews will be responsible for all excavations. They will carefully remove all litter, soil, and vertebrates. Litter and soil will be placed in separate containers, and each vertebrate species will be put in a clean separate jar and maintained at approximately 15°C. After excavation is completed, soil, litter, and vertebrates will be returned within 24 hours to the precise location from where they were removed. In restoring the site, litter and soil from the site will also be returned to the crater. Logs and flat stones from the immediate area will be placed over the soil. If additional soil and litter are required to fill the crater, both will be obtained within 100 feet of the site. While it is possible that there may be some incidental taking of Cheat Mountain salamanders, the impact to a population should be minimal. No cumulative effects on the viability of a Cheat Mountain salamander population are anticipated from Alternative 1.
SENSITIVE		
Southern Water Shrew	*Sorex palustris punctulatus*	As streams are not impacted, there should be no direct, indirect, or cumulative effect on the southern water shrew as a result of Alternative 1.
Cheat Minnow	*Rhinichthys bowersi*	As streams are not impacted, there should be no direct, indirect, or cumulative effect on the Cheat minnow as a result of Alternative 1.
Green Salamander	*Aneides aeneus*	There are no known populations of this species in the project area. If the ordnance removal activities do not occur in an area with potential habitat, there will be no direct, indirect, or cumulative effect to this species from Alternative 1.

Table 6-3
Evaluation of Impact of Alternative 1 on
Endangered, Threatened, and Sensitive Zoological Species
(Continued)

Common Name	Scientific Name	Impact of Alternative 1
SENSITIVE (Continued)		
Eastern Small-Footed Bat	*Myotis subulatus leibii*	There are no known caves or populations of this species in the project area, and there should be no direct, indirect, or cumulative effect to this species from Alternative 1.
Allegheny Woodrat	*Neotoma floridana magister*	Since there are no known populations in the project area, there should be no direct, indirect, or cumulative effects to this species from Alternative 1.
Southern Rock Vole	*Microtus chrotorrhinus cardinensis*	There are no known populations of this species in this area, and as a result, no direct, indirect, or cumulative effects are anticipated to this species from Alternative 1.
Northern Goshawk	*Accipiter gentilis*	No populations are known in the project area. If nests are not located, no direct, indirect, or cumulative effects are anticipated from Alternative 1.
Cerulean Warbler	*Dendroica cerulea*	There are no nesting records for this species in the project area, and as a result, there should be no direct, indirect, or cumulative effect to this species from Alternative 1.
Appalachian Cottontail	*Sylvilagus obscurus*	This is the only confirmed occurrence of a sensitive species known within the project area. However, because of the small size of area to be disturbed, there should be no direct, indirect, or cumulative effect to this species from Alternative 1.

Based on data presented in Dr. Pauley's Biological Evaluation (found in Appendix IV-C), it is concluded that only two listed species, the Cheat Mountain salamander and the Virginia northern flying squirrel, could be directly affected from implementing Alternative 1 in the Ordnance Removal Project in the Dolly Sods Wilderness. The Virginia northern flying squirrel would only be affected if trees are removed. If trees are not removed, Alternative 1 should not directly affect the Virginia northern flying squirrel. It is not anticipated that the proposed project will cause loss of viability of populations of any other endangered, threatened, or sensitive species.

If any other federally listed endangered, threatened, or sensitive species are observed during the implementation of this project, consultation among all appropriate parties, including the U.S. Forest Service, the U.S. Fish and Wildlife Service, and the West Virginia Department of Natural Resources, will be initiated.

6.2.1.3. Wilderness Resources

There are two impacts related to wilderness: the impact on the land, and the impact on users. Both are addressed within this section.

The key to wilderness impact is the "leave no trace" philosophy. The proposed ordnance removal will require disturbance of 105 acres. Brush cutting will be limited to that required to remove ordnance. It is anticipated that the disturbance will have no short- or long-term effect. There were minor impacts from the 1991 feasibility study, and the same type of methods will be followed in the proposed project, except on a smaller scale.

If the same density of metal is found, up to 201 holes may be excavated, up to 4 feet in campsites and 1 foot along the trails. These holes will be filled and tamped unless ordnance is found. Following the 1991 feasibility study, there was minor, temporary visual evidence of the excavations after they were filled. It is anticipated that there will be the same result from the proposed project. There will be no noticeable impact, either short- or long-term.

If ordnance is found in the same density, between 5 and 30 craters may be created, with the worst cases shown in Table 6-4. This data is based on a wet, sandy soil type. Experience from the 1991 feasibility study shows that due to the rocky nature of the soil, generally no crater is formed following detonation. In at least one instance in 1991, partially exposed ordnance was detonated in place. A crater of 1 to 1 1/2 feet in depth was created. It was filled with rocks and soil, and covered with leaf litter. In a reconnaissance by a Forest Service technician in the spring of 1995, that crater was difficult to recognize or attribute to ordnance disposal. Because much of Dolly Sods has rough terrain, it is very difficult to differentiate depressions caused by ordnance explosions in the 1991 feasibility study from depressions created by past logging activities, floods, and other acts of nature.

Where appropriate, a Forest Service official on-site working with the Corps of Engineers and the UXO team would determine if remediation were necessary, and to what degree, and identify a nearby borrow site for soil. The borrow site would be monitored to confirm that there are no archaeological remains in it. The crater would be filled, and erosion control devices would be placed to inhibit erosion if erosion were expected.

Creation of any sizeable craters will change microhabitats for all plants and should be viewed as undesirable. Craters or large depressions in wetlands will not cause serious problems and should not last for long periods of time.

Detonations in dry, rocky areas will also not cause serious short- or long-term impacts unless they are in the immediate vicinity of plants of special concern. The major negative impacts will occur in any deeper, well-developed, well-drained soils. Craters or depressions in these soils will remain for long periods of time and will require refilling if detonation causes

displacement. If possible, soil and leaf litter removed and saved during the initial excavation will be used.

From a wilderness use aspect, ordnance clearance will have a positive long-term impact. Even though there will be no guarantee that all ordnance is removed, high density use areas will be safer. A potential for hazard will still exist for users who venture off of established trails and campsites cleared by the UXO team. Of even more concern, should fires occur, a significant hazard would still be posed to fire fighters.

However, from a short-term perspective, wilderness use will be limited by the ordnance removal project. For public safety, a closed 4,000-foot safety zone will be established after excavation around the location where detonation is planned. However, techniques exist which allow reduction of this safety zone. The UXO team, the Forest Service technician on-site, and the Corps of Engineers safety specialist will decide on a case-by-case basis whether this safety zone can be decreased. This will cause closure of some trails at different times during the heavily used summer season. The zone will be opened following detonation. Generally, excavation and detonation occur on the same day. To lessen the impact on wilderness users, several suggestions have been made to the Forest Service by members of the public. The Corps of Engineers will send notices to past users and interested parties warning of some limits to use during the project. The Forest Service will provide signs and other information directing users to alternate sites.

In Hollenhorst and Stull-Gardner's 1991 *Dolly Sods Wilderness Area Study: Draft Report*, they found that most intensive use of the area occurs on weekends. They also found that the most important indicator of quality wilderness conditions to users were related to crowding. Visitors were not tolerant of seeing other parties near their campsites. Large groups (over six people) were not well accepted, and in fact, visitors preferred to see no more than three other parties each day while hiking.

Considering the sensitivity of Dolly Sods Wilderness users to crowding, the UXO technicians will not work on weekends or during holiday periods. This will significantly reduce the impact of ordnance removal on users. It is interesting to note that visitors polled during the 1991 feasibility study were accepting of UXO crews in the area, as they felt that wilderness quality would be improved. It is concluded that the ordnance removal project will have short-term, minor impact on the quality of the wilderness experience, and a positive impact on the land and future use.

Table 6-4
Anticipated Crater Depth

	60 mm	81 mm	105 mm	155 mm
No cover material				
Total Weight (lbs.)	3.2	9.4	33.0	94.6
Explosive Weight	0.34	2.1	5.1	15.4
Apparent crater depth (ft.)	0.8	1.4	1.9	2.7
Apparent crater diameter (ft.)	2.3	4.2	5.7	8.1
Apparent crater volume (cu. ft.)	1.6	10.1	24.4	70.8
True crater depth (ft.)	0.8	1.4	1.9	2.7
True crater diameter (ft.)	2.3	4.2	5.7	8.1
For 1 foot of tamped cover				
Apparent crater depth (ft.)	1.5	2.4	3.0	3.8
Apparent crater diameter (ft.)	3.7	6.2	7.8	10.3
Apparent crater volume (cu. ft.)	7.9	36.3	70.7	160.5
True crater depth (ft.)	1.5	2.4	3.0	3.8
True crater diameter (ft.)	4.2	7.1	9.0	11.8

6.2.1.4. Wetlands

Under 10% of the Dolly Sods Wilderness is wetlands. Procedures to protect wilderness areas are also more than adequate to protect wetlands. As the density and locations of ordnance are unknown, it is difficult to calculate the amount of excavation that may occur in wetland areas. Assuming that ordnance is equally distributed throughout the Dolly Sods Wilderness, up to 10% of the ordnance could be located in the wetlands. This could lead to 20 excavations and 3 rounds of ordnance being found in the wetlands. Neither excavation nor detonation would alter the course of a waterway or cause any permanent change in the condition of a wetland area. However, as all wetland areas will be maintained, impact will be minimal.

If it should be necessary to explode ordnance found in bogs or swamps, some short-term negative impacts should be expected. The nature of these wet, loose materials should, however, cause them to subside to their original configuration within a 2-year period, unless the soil is totally displaced to form a sizeable crater. To minimize this possibility, the use of mats should retain most soil materials on-site.

Some wetlands occur as riparian zones along streams. These areas could sustain greater short-term damage than bogs or swamps because of heavier clay soils. Long-term impacts should be minimal. The ordnance removal project will have no significant impact to wetlands in Dolly Sods.

Figure 6-2. Fisher Spring Run trail is adjacent to water in some areas. No ordnance will be detonated in stream beds.

6.2.1.5. Environmental Resources

The ordnance removal project will have no significant impact on environmental resources at the Dolly Sods Wilderness.

Air

No air quality impacts are associated with the project. Ordnance explosions may create limited dust. No motorized vehicles will be used in the wilderness area; no burning of vegetation will occur; no off-gases will be created by exploding ordnance. In the 1991 feasibility study, no impact to air quality was measured.

Water

No ordnance will be detonated in stream beds. If found there, ordnance will be removed for detonation. There are areas along trails that have steep slopes. Particular care will be taken on steep slopes and close to streams when performing initial surveys, as well as when ordnance is located, to avoid erosion. In the event that ordnance is located in such an area, the Forest Service employee on-site will provide technical guidance regarding ways to mitigate erosion should additional measures be required. In the 1991 feasibility study, no impact to water quality was measured.

Noise

Detonation related noise will be limited. If ordnance is found in the same density as in the 1991 feasibility study, between 5 and 30 pieces may be found and detonated. No motorized vehicles will be used, so there will be no associated noise. Noise impacts will not be significant.

Noise was heard by some wilderness users during the 1991 feasibility study, but none complained. Disturbances were brief, and limited to horn blasts and sounds of detonations. Notices were posted to explain the source and reason for the noise. Most visitors to Dolly Sods, interviewed by the Forest Service, felt that increased safety was adequate justification for the noise.

6.2.1.6. Cultural Resources

The cultural resource studies include a literature review, a review by the West Virginia State Historic Preservation Office, and interviews with Forest Service archaeologists. According to state records, there are no archaeologically or architecturally significant sites within the wilderness area listed. However, Forest Service archaeologists have provided data, some of which was generated during the 1991 feasibility study, that denotes areas of significance. In

general, because an archaeological assessment has not been conducted, it is difficult to determine the extent of sites, and consequently, the impact of the proposed action.

An issue of concern to the Forest Service archaeologists was the treatment given to artifacts during the 1991 feasibility study. Many were removed from the ground, with no photo record or contextual record taken. As a result, their value was greatly diminished. For the proposed project, plans are in place to see that such occurrences are not repeated.

Prior to initiation of the ordnance removal project, an archaeologist will perform a visual survey of the trails and campsites to locate potential culturally significant sites, perform an initial assessment, mark map locations, and develop a report. Recommendations for future requirements will be developed at that time. The report will follow criteria set forth in the National Historic Preservation Act of 1966.

The National Register was authorized under the 1935 Historic Sites Act and was expanded under the National Historic Preservation Act of 1966. The National Register is the authoritative guide used by federal, state, and local governments, as well as private groups interested in preservation of cultural resources. It is used as a guide to identify the historic resources which have national, state, or local significance and in addition are deserving of preservation. Several criteria are used in the evaluation of sites. The major criteria are:

- that they are associated with events that have made a significant contribution to the broad patterns of our history;

- that they are associated with the lives of persons significant in our past;

- that they embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or

- that they have yielded or may be likely to yield information important in prehistory or history (National Register Bulletin #24, p. 5-6).

When the ordnance removal project begins, if a Forest Service recommendation cannot be followed, the Corps of Engineers will notify the Forest Service archaeologist to work out a compromise.

As the ordnance removal occurs, cultural resource sites may be identified. As items are excavated, photos will be taken to document the item in context with its surroundings. Location will be mapped. Complete descriptions, photographs, and locations (north/south and east/west coordinates, horizontal and vertical control) are critical to allow cost-effective and

accurate assessment of the historic resources of the area. Information should be maintained to document:

- location of excavated pit;
- horizontal and vertical location of artifact;
- photos of artifact;
- sketch/photo of artifact;
- sketch of site area (i.e., site map);
- site form filled out and submitted to State Historic Preservation Office; and
- date and name of person(s) on crew who filled out the form.

All items except ordnance will be left in the ground. In the event of questions, an archaeologist will be contacted for guidance. If prehistoric artifacts are found, work will cease and the Forest Service archaeologist will be immediately notified.

Criteria which will help UXO contractors evaluate archaeological sites have been developed and are listed below. The evaluation of each site may be dependent on some of these criteria and they should be used in conjunction with one another, not independently, to judge whether an archaeologist should be called. For example, under age, early sites may be judged more significant if they also fulfill conditions of good preservation and integrity. Likewise, a well-preserved site from the late prehistoric would be more significant than a disturbed early prehistoric site.

- Age: Early sites, both prehistoric and historic are more significant.

- Regional Interest: Sites which have an impact on regional and local research problems are more significant.

- National Interest: Sites which have an impact on national and universal problems are more significant.

- Preservation: Sites containing well-preserved remains are more significant.

- Degree of Erosion: Sites which exhibit smaller percentages of disturbance by erosion or development are more significant.

- Stratification: Well-stratified sites and dateable sites with several components are more significant.

- Size and Depth: Larger sites and those with deep deposits of cultural material are more significant.

- Uniqueness: Sites containing, or composed of, rare or unique features (burial mounds, ossuaries, early man sites) are more significant.

- Previous Knowledge: Site types about which little is known are more significant.

- Public Significance: Sites which may easily be used in public education programs due to site contents and accessibility for public viewing are more significant.

As a result of the inclusion of mitigation plans in the ordnance removal procedures, the action will have a positive impact on cultural resources at the Dolly Sods Wilderness, in that those resources will be identified for future study.

6.2.1.7. Socioeconomic Resources

The socioeconomic impact of this alternative is difficult to calculate. Due to the limited data available regarding tourism, it cannot be predicted with accuracy whether: (1) the ordnance removal will inhibit use of the Dolly Sods Wilderness over the 6-month project period, and (2) to what degree the impact would be felt. From other projects of this nature, there have been both positive and negative impacts which negate each other. Negative impacts include loss of revenues from a few "tourists" that come to the area during clean-up that will leave or reduce their visitation time. Positive impacts could be realized during the clean-up from the jobs created from the clean-up activities. Therefore, although the net economic impact is unclear, it may be near zero.

In the longer term, the ordnance removal project will have a positive economic impact. With ordnance removed from trails and campsites, the United States Forest Service will be able to allocate its maintenance funds in a fashion that would otherwise not be possible. For example, with ordnance removed from trails and campsites, crews will be able to work on trail maintenance projects without attempting to locate ordnance first. Work will proceed more quickly, and therefore, limited funds for such activities will be stretched farther.

6.2.1.8. Public Safety

Ordnance presents an insidious risk. Its presence and potential for harm are not readily recognizable by the public. The Forest Service, as manager of the wilderness, has an obligation to reduce the danger posed by ordnance. Alternative 1, removal of ordnance from trails and campsites, provides a safe and useable corridor through the most intensively used areas of Dolly Sods.

For Alternative 1, clearance of ordnance from campsites is of particular importance as these are the areas where wilderness use techniques call for activities which could cause ordnance to detonate—digging to bury waste, creation of fire pits and fire, insertion of tent pegs into the ground. Clearance of ordnance from trails will ensure that hikers and hunters have safe

access to the wilderness also. Forest Service employees and volunteers who perform trail maintenance will be protected from danger of unexploded ordnance.

Danger will remain for users of Dolly Sods who venture from trails and campsites. For example, while hunters use trails and roads for access to the wilderness, they often leave the trails. High risk will also remain for fire fighters in the event of a forest fire.

While Alternative 1, removal of ordnance from trails and campsites, may not address the totality of the risk to users of the Dolly Sods Wilderness, it does address the obvious risks. The public will be provided with a safe and useable area through which the wilderness can be enjoyed. Access to one of the most popular wilderness areas in the eastern United States will be maintained.

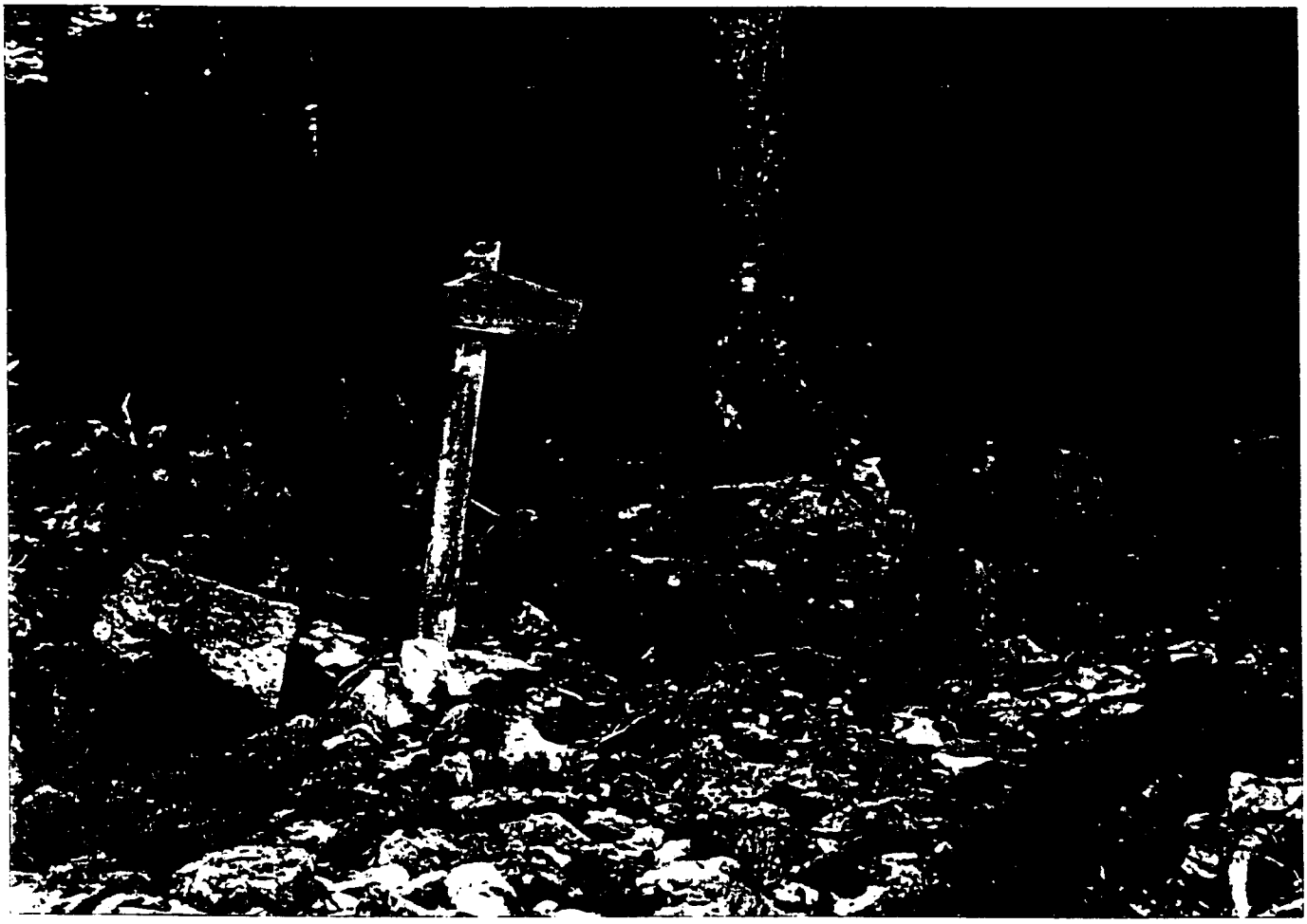

Figure 6-3. Intersection of Fisher Spring Run and Rohrbaugh Plains trails. The rocky terrain will minimize the impact of crater formation in the event of detonation.

6.3. Alternative 2—Removal of Ordnance from Trails—Clearing hiking trails and an area 20 feet on each side to a depth of 1 foot, but not clearing campsites. This alternative has an important distinction from Alternative 1. Campsites, which are areas of extended use, and in which digging, probing, and fire building occur, will not be cleared of ordnance. Danger posed by ordnance is greatest in campsite areas due to the activities performed there.

There are 20.8 miles of trails in the Dolly Sods Wilderness encompassing 103.8 acres. Trails will be searched their entire length and 20 feet to each side by UXO specialists using hand-held detection devices such as metal detectors. The surface visual sweeps and subsurface vegetation sweeps will be conducted leaving vegetation intact where possible. If metal is indicated, the site will be inspected by a Forest Service employee, providing on-site oversight and assistance. Issues such as the presence of endangered species or digging on steep slopes will be addressed on a case-by-case basis by the Forest Service employee.

The area will be excavated by hand to a depth of 1 foot. If materials other than ordnance are found, location will be noted, and a photo taken showing the item in context with its surroundings. The item will be returned to the hole, then the hole will be filled using excavated material, and hand-tamped.

If ordnance is found, it will be detonated in place. The Forest Service official will determine the level and type of remediation necessary. It could range from no action, should the site be rocky and the disturbance minimal, to importing fill from a borrow source within the wilderness area, reseeding, and impeding erosion through placement of sediment barriers or other erosion-control devices. A summary of environmental consequences is provided in Table 6-5.

Table 6-5
Summary of Environmental Consequences
Alternative 2—Removal of Ordnance From Trails

Resource	Action and Effect	Mitigation Measures
Botanical	Walk through 103.8 acres; disturb up to 563 sq. ft. of vegetation through excavation and detonation; vegetation will return within 1 year. No brush cutting except to access ordnance. No significant impact. Project will include documentation of locations of sensitive and rare species. This will contribute to scientific database, a positive impact.	Document location and transplant sensitive species to suitable habitat or reseed as appropriate. Species will be appropriate for site.

Table 6-5
Summary of Environmental Consequences
Alternative 2—Removal of Ordnance From Trails
(Continued)

Resource	Action and Effect	Mitigation Measures
Zoological/Wildlife	Walk through 103.8 acres; mobile species will move during project, then return. Immobile species may suffer incidental taking. No short-term or long-term effect on wildlife. Project will include documentation of locations of endangered, threatened, and sensitive species. This will contribute to scientific database, a positive impact.	Document location of endangered, threatened, and sensitive species. Collect and hold Cheat Mountain salamander prior to detonations, then replace. During detonation of ordnance, if found in the habitat of the Virginia northern flying squirrel, noise-deadening techniques will be used.
Wilderness	Disturb 103.8 acres; disturb up to 563 sq. ft. of vegetation. No visual impact. Use of limited areas in the wilderness for recreation will be limited for up to 6 months during ordnance removal. Long-term public safety will be improved. Also, an evidence of human use (ordnance) will be removed. This will be a positive impact. New topographic maps will be created by the Corps of Engineers based on detailed aerial photography of the wilderness. These maps will be available to wilderness managers and users; a positive impact.	Disturbed areas will be remediated for esthetics. Visitors to Dolly Sods Wilderness will be provided with information regarding alternative use areas.
Wetlands	No waterways will be altered. Ordnance found and detonated in wetlands will cause craters to be formed; original configuration will return within 2 years.	Ordnance found in waterways will be removed then detonated.
Environmental air/water/soils/noise	No air emissions. No aqueous or solid waste emissions. If ordnance is located in waterway, it will be moved and detonated away from stream. Noise (between 5 and 30 detonations of ordnance) may be heard. All equipment is noise-free, so no contribution to ambient noise will be made. No significant impact.	Soil erosion and stream sedimentation will be controlled through proven techniques. Noise will be dampened by covering ordnance with sandbags.

Table 6-5
Summary of Environmental Consequences
Alternative 2—Removal of Ordnance From Trails
(Continued)

Resource	Action and Effect	Mitigation Measures
Cultural	Project will include survey to document locations of cultural resources. Survey will contribute to archaeological database, a positive impact.	Archaeologist to conduct complete literature review of historic logging activities and develop comparative file to evaluate potential significance of historic remains; on-site investigation by trained archaeologist to identify cultural remains as necessary.
Socioeconomic	Use levels of the Dolly Sods Wilderness may decline for up to 6 months, during ordnance removal. However, UXO work crews will contribute to area economy. No net impact in the near-term. Long-term impact is positive. Maintenance of trails can be conducted without first searching for ordnance. Funds can be allocated directly for maintenance rather than for ordnance searches.	UXO teams will work in isolated areas will limit access to one area at a time. Other areas will remain open to users.
Public Safety	Campsites will not be cleared and will remain areas of high use and highest risk. Risk will also remain for those who leave the trails, such as hunters. High risk will remain in the event of a forest fire.	Fire control will be implemented by UXO crews and Forest Service employees.

6.3.1. Direct and Indirect Effects and Their Significance; Mitigation Measures

This Alternative involves clearing hiking trails and an area 20 feet on each side to a depth of 1 foot, but not clearing campsites. This alternative has an important distinction from Alternative 1. Campsites, which are areas of extended use, and in which digging, probing, and fire building occur, will not be cleared of ordnance. Danger posed by ordnance is greatest in campsite areas due to the activities performed there.

6.3.1.1. Botanical Resources

The work plan calls for cutting no vegetation, unless necessary to access a piece of ordnance. The impact, then, would be a result of the disturbance of 103.8 acres, of excavating up to 198 holes, and detonation of between 5 and 30 pieces of ordnance. Potentially, up to 563 square

feet of vegetation could be disturbed from excavation and detonation activities. Minor impacts to vegetation in the 1991 feasibility study were due to walking on the surface.

Botanical field surveys indicate the presence of many interesting plant communities within the wilderness area including:

- cranberry-beakrush-sedge bogs;
- blueberry-huckleberry heath communities;
- grass balds;
- quaking aspen groves; and
- windswept red spruce communities.

According to published data, there are no botanical endangered species known to be in the Dolly Sods Wilderness. The habitat exists for one endangered species, running buffalo clover, however, the plant has not been found in field surveys. However, there are 41 species in the general federal category which includes endangered, threatened and sensitive; there are 378 species listed in the rare category by the West Virginia Department of Natural Resources.

Special attention has been assigned to measuring the impact on endangered, threatened, and sensitive species, and on rare species. To identify impacts to these sensitive botanical populations, the probability of occurrence and impact are addressed for each species of concern in Appendix III. Also included is a plan for mitigation of impact. The mitigation plan includes procedures which will be incorporated into the UXO crew's work plan. As a result, Alternative 2 would have no significant impact on botanical species at the Dolly Sods Wilderness.

All endangered, threatened, sensitive and rare plants known or thought to occur in the Monongahela National Forest are listed in Appendix III. Thirty-seven of these plant species are felt to have a significantly high chance or are known to occur in the Dolly Sods Wilderness. All plants were categorized by "impact" and "occurrence".

Probable Impact of Ordnance Removal alternatives were categorized as follows:

- 1. **Major**—Potential major negative impacts are likely to occur because these plants are fragile, have shallow fibrous root systems, grow in wet or loose soils, and basically are herbs, forbs, ferns, or sedges.

- 2. **Considerable**—Potential exists for substantial damage to 33% or more of a plant population in an affected area.

- 3. **Minor**—Potential exists for substantial damage to occur to less than 33% of the plant population. Many of these plants are perennials or have well-developed root systems.

- 4. **None**—This category contains plants where insignificant damage is likely to occur or it is "very unlikely" that this plant species grows in the Dolly Sods Wilderness.

Likelihood of Occurrence is classified into four categories:

- 1. **Present**—This species is known to be present in the Dolly Sods Wilderness.

- 2. **Probable**—This species has a high probability of occurring in the ordnance removal area or is known to exist in similar sites in Canaan Valley or at other locations on or near Dolly Sods.

- 3. **Possible**—This species has a greater than 33% chance of occurring in the Dolly Sods Wilderness. The species is known to occur in similar habitat conditions and/or relatively nearby locations.

- 4. **Doubtful**—It is unlikely this species exists in the Dolly Sods Wilderness.

- 5. **Very Unlikely**—This species category indicates plants that probably do not occur in the Dolly Sods Wilderness because of habitat requirements and known geographic ranges.

Seven species on the "rare" list are known to grow in the Dolly Sods Wilderness. Thirty species were assigned the "probable" rating of occurring in the Dolly Sods Wilderness. Efforts should be made to eliminate impacts to or provide maximum protection for these species during any ordnance removal. Thirty-one of these 37 species are estimated to potentially be negatively impacted in either a "major" or "considerable" way if ordnance removal is completed on sites where these plant populations occur.

The running buffalo clover is the only endangered species with a "probable" rating. The plant has not been found in the Dolly Sods Wilderness, however, it grows in moist, wooded areas in disturbed soils around Parsons, West Virginia, 15 miles from Dolly Sods. Some Dolly Sods Wilderness habitats would support running buffalo clover. It is anticipated that ordnance removal would not impact running buffalo clover populations. In fact, by disturbing soils, the removal action would have a positive impact on the running buffalo clover by creating disturbed soils.

Thirty of the 37 "present" or "probable" species occur in bogs, swamps, or wetland soils. These soils are subject to minor erosion but would be very subject to displacement and cratering should any underground ordnance be exploded without a mat to hold the soil in place. Most of these plants are characterized by having shallow, fibrous root systems. Entire plants or clumps of grasses and sedges could be easily blown away. Ordnance removal in

late summer or fall will provide plants a greater opportunity to produce seeds and be correctly identified.

Two of the 37 "present" or "probable" species (fly honeysuckle and balsam poplar) are perennials and would likely sustain only minor damage during ordnance removal because they occur in moist woods where other roots would absorb considerable force.

Five of the 37 "present" or "probable" species occur in dry, rocky habitats. These species are white alumroot, heart-leaved paper birch, paper birch, purple virgin's bower, and three-toothed cinquefoil. Only the purple virgin's bower and three-toothed cinquefoil are likely to sustain major damage, because of long vining branches and relatively shallow root systems, respectively.

Six of the 37 "present" or "probable" species are trees or shrubs. These should maintain less damage than most herbs, grasses, sedges or rushes.

It should be recognized that many of the plants that are listed as "present", "probable", or "possible" (the three most likely categories to occur in the Dolly Sods Wilderness) will be difficult, and probably impossible, for anyone other than a professional botanist to correctly identify. Thirteen of the plants are grasses, sedges or rushes which may only be identified during a short period of the growing season when flowers and/or seeds are present. Some of these plants, such as the running buffalo clover, have not been found in the Dolly Sods Wilderness. This situation strongly dictates a process as follows:

- Step 1— Locate any ordnance;
- Step 2— Have a professional botanist, wildlife biologist, etc., check the site for biotic element presence; then
- Step 3— Explode the ordnance.

Short-term effects on most of the plants could be negative. However, most of the "present" and "probable" plants produce good to abundant crops of seeds most years. If ordnance removal occurs late in the year, the plants will have had a chance to produce seed prior to any disturbances. Most of the biological characteristics of these plants are relatively unknown but it is speculated they do have some seeds stored in the "seed bank" of the litter and upper layer of soil.

Five of the plants probably do not meet these characteristics and should receive more careful attention. They are grass pink orchid, goldthread, rose pogonia, swamp saxifrage, and oceanurus. Long-term prospects for all but the previously mentioned five plants should be at least equal to their present status.

Because of the presence of sensitive biological resources occurring within the Dolly Sods Wilderness, specific mitigation plans have been developed to reduce impacts. There are no

endangered species known to be present, however, due to the varying ecology within the wilderness area, there are varying types and degrees of mitigation techniques required. Appropriate mitigation techniques that will be employed include:

- A review of the work plan with the Potomac District Ranger or her designee. This will allow issues of concern to be raised and addressed so that proper planning can occur.

- Following metal detection and prior to excavation, photos of the area will be taken to document botanical species. This data will be forwarded to Department of Natural Resources and Forest Service botanists at the conclusion of the project.

- Prior to detonation of ordnance, the area will be surveyed for threatened and endangered species by a biologist.

- Following detonation of ordnance, the Forest Service employee will determine if the crater area requires remediation. Generally, based on experiences from the 1991 feasibility study, it appears that no crater will be apparent due to the rocky nature of the land. However, should a crater need to be filled, soil will be taken from the surrounding borrow area. In order to maintain the ecological integrity, the soil from the borrow area will be matched for pH and soil type of the disturbed area. The borrow area will be within a 100-foot radius of the impact area and contain no endangered, threatened, or sensitive species. The soil will be reseeded with a native species, such as Allegheny flyback or crinkle grass, as appropriate. Erosion will be controlled with appropriate measures.

6.3.1.2. Zoological/Wildlife Resources

The approach to identifying impacts to zoological populations and to developing effective mitigation plans was to conduct a formal biological assessment. This best quantifies impact, and is appropriate as the project may lead to an incidental taking of a threatened species, the Cheat Mountain salamander. Dr. Tom Pauley, a recognized expert on Cheat Mountain salamanders, performed the assessment. Results of that assessment are presented in Appendix IV; the impact on each species of concern is addressed. It is concluded that, due to the inclusion of good, workable mitigation plans, there will be no significant impact on any zoological populations resulting from ordnance removal.

Because of the presence of sensitive zoological resources occurring within the Dolly Sods Wilderness, specific mitigation plans have been developed to reduce impacts. Due to the varying ecology within the wilderness area, varying types and degrees of mitigation techniques are required. A Forest Service employee will be present on-site to help determine appropriate mitigation techniques that include:

- A review of the work plan each week with the Potomac District Ranger or her designee. This will allow issues of concern to be raised and addressed so that proper planning can occur.

- Following metal detection and prior to excavation, a walk-through inspection of the area by a qualified biologist to identify the presence of any species of concern. The organism will be moved, if appropriate and possible.

- The walk-through will be conducted at night, as the salamanders are nocturnal. If salamanders are found within 40 feet of excavation, they will be removed and stored in a jar. Prior to excavation, leaf litter and top soil will be carefully removed and preserved. Following excavation, and detonation (if required), the top soil, leaf litter, and any salamanders will be returned to the original area where they were found. By following this routine, there will be no cumulative effects on the salamander population.

Detailed procedures have been developed to reduce the impact of excavation and detonation of ordnance on zoological species. The procedures are outlined in the biological assessment, included in Appendix IV, and will be included in the UXO technicians' work plan, as presented in Section 4.1.2.

To avoid impacts to the Cheat Mountain salamander, prior to excavation, leaf litter and topsoil will be collected and saved for replacement after excavation. Any reptiles or amphibians found prior to excavation will be contained and subsequently released to the place originally found. This will cause no significant impact on the Cheat Mountain salamander population.

To avoid impacts to the Virginia northern flying squirrel, special detonation techniques will be used in areas of potential habitat. The techniques include sandbag covers to reduce noise and flying shrapnel. As a result, there will be no significant impact on the Virginia northern flying squirrel.

The endangered, threatened, and sensitive zoological species with a possible likelihood of occurrence in the Dolly Sods Wilderness are listed in Appendix IV. An evaluation of the effect of Alternative 2, removal of ordnance from trails, is presented in Table 6-6.

In a telephone conversation with the president of the Brooks Bird Club, Mr. LeJay Graffious, the Biological Evaluation was discussed. He concurred with locations of birds, as well as potential effects presented in Table 6-6. It was recommended that noise dampening techniques be used when ordnance is detonated so as to reduce impact on birds migrating in spring and fall, and nesting during summer months.

Based on data presented in Dr. Pauley's Biological Evaluation (found in Appendix IV-C), it is concluded that only two listed species, the Cheat Mountain salamander and the Virginia northern flying squirrel, could be directly affected from implementing Alternative 2 in the Ordnance Removal Project in the Dolly Sods Wilderness. The Virginia northern flying squirrel would only be affected if trees are removed. If trees are not removed, Alternative 2 should not directly affect the Virginia northern flying squirrel. It is not anticipated that the Alternative 2 would cause loss of viability of populations of any other endangered, threatened, or sensitive species.

If any other federally listed endangered, threatened, or sensitive species are observed during the implementation of this project, consultation among all appropriate parties, including the U.S. Forest Service, the U.S. Fish and Wildlife Service, and the West Virginia Department of Natural Resources, will be initiated.

Table 6-6
Evaluation of Impact of Alternative 2 on Endangered, Threatened, and Sensitive Zoological Species

Common Name	Scientific Name	Impact of Alternative 2
ENDANGERED AND THREATENED		
Gray Wolf	*Canis lupus*	Since the gray wolf no longer occurs in West Virginia, no direct, indirect, or cumulative effects are anticipated from Alternative 2. The size of this project area is large enough to support the gray wolf in the event of a future reintroduction program. However, there are no plans for reintroduction of the gray wolf into West Virginia.
Eastern Cougar	*Felis concolor couguar*	Although this project area is large enough to support the cougar, Alternative 2 is very limited in area and would not create an irretrievable loss of potential habitat.
Virginia Big-Eared Bat	*Plecotus townsendii virginianus*	There are no records of occurrence or suitable potential habitat of the Virginia big-eared bat in the project area. As a result, direct, indirect, or cumulative effects are not anticipated on the Virginia big-eared bat from Alternative 2.
Indiana Bat	*Myotis sodalis*	There are no records of occurrence or suitable potential habitat of the Indiana bat in the project area, therefore, no direct, indirect, or cumulative effects are anticipated on the Indiana bat from Alternative 2.

Table 6-6
Evaluation of Impact of Alternative 2 on
Endangered, Threatened, and Sensitive Zoological Species
(Continued)

Common Name	Scientific Name	Impact of Alternative 2
ENDANGERED AND THREATENED (Continued)		
Peregrine Falcon	*Falco peregrinus*	Peregrine falcons have not been observed in the project area, but the Red Creek canyon does have potential habitat. Detonation of ordnance in the area of a nest could have a negative impact on nesting birds. Before detonation, all sites should be examined for nests by a qualified biologist. If nests are not present, no direct, indirect, or cumulative effects are anticipated in Alternative 2.
Virginia Northern Flying Squirrel	*Glaucomys sabrinus fuscus*	There is one known population of the Virginia northern flying squirrel in the project area (Figure 5-1(c)). This population is near the northwest corner of the Dolly Sods Wilderness. Other sites within the project area could have suitable habitat (i.e., large red spruce trees) for the Virginia northern flying squirrel. In all potential habitat where ordnance must be detonated, UXO crews should use noise-deadening techniques (i.e., sand bags). This should reduce the disturbances to the Virginia northern flying squirrel and as a result, no cumulative effects are anticipated from Alternative 2. To avoid disturbing the Virginia northern flying squirrel, April and May have been suggested as the best times to detonate ordnance.
Bald Eagle	*Haliaeetus leucocephalus*	There are no historical records of nest sites in the Dolly Sods Wilderness. Bald eagles are rare in West Virginia with most sightings reported during migration. Possible migration over the project area could occur. However, there are no large bodies of water in the project area which would provide suitable feeding and nesting sites. No direct, indirect, or cumulative effects would be expected on the bald eagle from Alternative 2.

Table 6-6
Evaluation of Impact of Alternative 2 on
Endangered, Threatened, and Sensitive Zoological Species
(Continued)

Common Name	Scientific Name	Impact of Alternative 2
ENDANGERED AND THREATENED (Continued)		
Cheat Mountain Salamander	*Plethodon nettingi*	If ordnance must be removed or detonated, digging holes, and detonation of ordnance could directly affect the Cheat Mountain salamander. However, specific procedures have been designed to minimize potential impact on the Cheat Mountain salamander. Prior to any excavation, a qualified biologist will assess the site for potential Cheat Mountain salamander habitat. The area to be surveyed will include the estimated size of the crater plus an area of 40-foot radius. Unexploded ordnance (UXO) crews will be responsible for all excavations. They will carefully remove all litter, soil, and vertebrates. Litter and soil will be placed in separate containers, and each vertebrate species will be put in a clean separate jar and maintained at approximately 15°C. After excavation is completed, soil, litter, and vertebrates will be returned within 24 hours to the precise location from where they were removed. In restoring the site, litter and soil from the site will also be returned to the crater. Logs and flat stones from the immediate area will be placed over the soil. If additional soil and litter are required to fill the crater, both will be obtained within 100 feet of the site. While it is possible that there may be some incidental taking of Cheat Mountain salamanders, the impact to a population should be minimal. No cumulative effects on the viability of a Cheat Mountain salamander population are anticipated from Alternative 2.
SENSITIVE		
Southern Water Shrew	*Sorex palustris punctulatus*	As streams are not impacted, there should be no direct, indirect, or cumulative effect on the Southern water shrew as a result of Alternative 2.
Cheat Minnow	*Rhinichthys bowersi*	As streams are not impacted, there should be no direct, indirect, or cumulative effect on the Cheat minnow as a result of Alternative 2.

Table 6-6
Evaluation of Impact of Alternative 2 on
Endangered, Threatened, and Sensitive Zoological Species
(Continued)

Common Name	Scientific Name	Impact of Alternative 2
SENSITIVE (Continued)		
Green Salamander	*Aneides aeneus*	There are no known populations of this species in the project area. If the ordnance removal activities do not occur in an area with potential habitat, there will be no direct, indirect, or cumulative effect to this species from Alternative 2.
Eastern Small-Footed Bat	*Myotis subulatus leibii*	There are no known caves or populations of this species in the project area, and there should be no direct, indirect, or cumulative effect to this species from Alternative 2.
Allegheny Woodrat	*Neotoma floridana magister*	Since there are no known populations in the project area, there should be no direct, indirect or cumulative effects to this species from Alternative 2.
Southern Rock Vole	*Microtus chrotorrhinus cardinensis*	There are no known populations of this species in this area, and as a result, no direct, indirect, or cumulative effects are anticipated to this species from Alternative 2.
Northern Goshawk	*Accipiter gentilis*	No populations are known in the project area. If nests are not located, no direct, indirect, or cumulative effects are anticipated from Alternative 2.
Cerulean Warbler	*Dendroica cerulea*	There are no nesting records for this species in the project area, and as a result, there should be no direct, indirect, or cumulative effect to this species from Alternative 2.
Appalachian Cottontail	*Sylvilagus obscurus*	This is the only confirmed occurrence of a sensitive species known within the project area. However, because of the small size of area to be disturbed, there should be no direct, indirect, or cumulative effect to this species from Alternative 2.

6.3.1.3. Wilderness Resources

The key to wilderness impact is the "leave no trace" philosophy. Brush cutting will be limited to that required to remove ordnance. It is anticipated that the walk-through by UXO crews of over 103.8 acres will have no short- or long-term effects. There were minor impacts from the 1991 feasibility study, and the same type of methods would be followed in Alternative 2, except on a smaller scale.

If the same density of metal is found, up to 198 holes may be excavated, up to 1 foot along the trails. These holes will be filled and tamped unless ordnance is found. Following the 1991 feasibility study, there was minor, temporary visual evidence of the excavations after they were filled. It is anticipated that there would be the same result from the implementation of Alternative 2. There would be no noticeable impact, either short- or long-term.

If ordnance is found in the same density, between 5 and 30 craters may be created, with the worst cases shown in Table 6-4. This data is based on a wet, sandy soil type. Experience from the 1991 feasibility study shows that due to the rocky nature of the soil, generally no crater is formed following detonation. In at least one instance in 1991, partially exposed ordnance was detonated in place. A crater of 1 to 1 1/2 feet in depth was created. It was filled with rocks and soil, and covered with leaf litter. In a reconnaissance by a Forest Service technician in the spring of 1995, that crater was difficult to attribute to ordnance disposal. Because much of Dolly Sods has rough terrain, it is very difficult to differentiate depressions caused by ordnance explosions in the 1991 feasibility study from depressions caused by past logging activities, floods, and other acts of nature.

In a worst case scenario, it would be necessary to remediate the area. A Forest Service official on-site working with the Corps of Engineers and the UXO team would determine if remediation were necessary, and to what degree, and identify a nearby borrow site for soil. The borrow site would be monitored to confirm that there are no archaeological remains in it. The crater would be filled, and erosion control devices would be placed to inhibit erosion if erosion were expected.

Creation of any sizeable craters will change microhabitats for all plants and should be viewed as undesirable. Craters or large depressions in wetlands will not cause serious problems and should not last for long periods of time.

Detonations in dry, rocky areas will also not cause serious short- or long-term impacts unless they are in the immediate vicinity of plants of special concern. The major negative impacts will occur in any deeper, well-developed, well-drained soils. Craters or depressions in these soils will remain for long periods of time and will require refilling if detonation causes displacement.

From a wilderness use aspect, ordnance clearance will have a positive long-term impact. Even though there will be no guarantee that all ordnance is removed, high density use areas will be safer. A potential for hazard will still exist for users who venture off of established trails and campsites cleared by the UXO team. Should fires occur, a significant hazard would still be posed to fire fighters.

However, from a short-term perspective, wilderness use will be limited by the ordnance removal project. For public safety, a closed 4,000-foot safety zone will be established after excavation around the location where detonation is planned. However, techniques exist which

allow reduction of this safety zone. The UXO team, the Forest Service technician on-site, and the Corps of Engineers safety specialist will decide on a case-by-case basis whether this safety zone can be decreased. This will cause closure of some trails at different times during the heavily used summer season. To lessen the impact on wilderness users, several suggestions have been made to the Forest Service by members of the public. The Corps of Engineers will send notices to past users and interested parties warning of some limits to use during the project. The Forest Service will provide signs and other information directing users to alternate sites.

In Hollenhorst and Stull-Gardner's 1991 *Dolly Sods Wilderness Area Study: Draft Report*, they found that most intensive use of the area occurs on weekends. They also found that the most important indicator of quality wilderness conditions to users were related to crowding.

Visitors were not tolerant of seeing other parties while hiking. Large groups (over six people) were not well accepted, and in fact, visitors preferred to see no more than three other parties each day while hiking.

Considering the sensitivity of Dolly Sods Wilderness users to crowding, the UXO technicians will not work on weekends or during holiday periods. This will significantly reduce the impact of ordnance removal on users. It is interesting to note that visitors polled during the 1991 feasibility study were accepting of UXO crews in the area, as they felt that wilderness quality would be improved. It is concluded that the implementation of Alternative 2 would have short-term, minor impacts on the quality of the wilderness experience, and positive impacts on the land and on future use.

6.3.1.4. Wetlands

Under 10% of the Dolly Sods Wilderness is wetlands. Procedures to protect wilderness areas are also more than adequate to protect wetlands. As the density and locations of ordnance are unknown, it is difficult to calculate the amount of excavation that may occur in wetland areas. Assuming that ordnance is equally distributed throughout the Dolly Sods Wilderness, up to 10% of the ordnance could be located in the wetlands. This could lead to 20 excavations and 3 rounds of ordnance being found in the wetlands. Neither excavation nor detonation would alter the course of a waterway or cause any change in the condition of a wetland area. However, as all wetland areas will be maintained, impact will be minimal.

If it should be necessary to explode ordnance found in bogs or swamps, some short-term negative impacts should be expected. The nature of these wet, loose materials should, however, cause them to subside to their original configuration within a 2-year period, unless the soil is totally displaced to form a sizeable crater. To minimize this possibility, the use of mats should retain most soil materials on-site.

Some wetlands occur as riparian zones along streams. These areas could sustain greater short-term damage than bogs or swamps because of heavier clay soils. Long-term impacts should be minimal. The implementation of Alternative 2 would have no significant impact to wetlands in Dolly Sods.

6.3.1.5. Environmental Resources

The ordnance removal project will have no significant impact on environmental resources at the Dolly Sods Wilderness.

Air

No air quality impacts are associated with the project. Ordnance explosions may create limited dust. No motorized vehicles will be used in the wilderness area; no burning of vegetation will occur; no off-gases will be created by exploding ordnance. In the 1991 feasibility study, no impact to air quality was measured.

Water

Detonation of ordnance may cause the formation of craters. Erosion will be controlled through the use of mulch. There are areas along trails that have steep slopes. Particular care will be taken on steep slopes and close to streams when performing initial surveys, as well as when ordnance is located. In the event that ordnance is located in such an area, the Forest Service employee on-site will provide technical guidance regarding ways to mitigate erosion should additional measures be required. In the 1991 feasibility study, no impact to water quality was measured.

Noise

Detonation related noise will be limited. If ordnance is found in the same density as in the 1991 feasibility study, between 5 and 30 pieces may be found and detonated. No motorized vehicles will be used, so there will be no associated noise. Noise impacts will not be significant.

Noise was heard by some wilderness users during the 1991 feasibility study, but none complained. Disturbances were brief, and limited to horn blasts and sounds of detonations. Notices were posted to explain the source and reason for the noise. Most visitors to Dolly Sods, interviewed by the Forest Service, felt that increased safety was adequate justification for the noise.

6.3.1.6. Cultural Resources

The cultural resource studies include a literature review, a review by the West Virginia State Historic Preservation Office, and interviews with Forest Service archaeologists. According to state records, there are no archaeologically or architecturally significant sites within the wilderness area listed. However, Forest Service archaeologists have provided data, some of which was generated during the 1991 feasibility study, that denotes areas of significance. In general, because an archaeological assessment has not been conducted, it is difficult to determine the extent of sites, and consequently, the impact of the proposed action.

An issue of concern to the Forest Service archaeologists was the treatment given to artifacts during the 1991 feasibility study. Many were removed from the ground, with no photo record or contextual record taken. As a result, their value was greatly diminished. For the proposed project, plans are in place to see that such occurrences are not repeated.

Prior to initiation of the ordnance removal project, an archaeologist will perform a visual survey of the trails and campsites to locate potential culturally significant sites, perform an initial assessment, mark map locations, and develop a report. Recommendations for future requirements will be developed at that time. The report will follow criteria set forth in the National Historic Preservation Act of 1966.

The National Register was authorized under the 1935 Historic Sites Act and was expanded under the National Historic Preservation Act of 1966. The National Register is the authoritative guide used by federal, state, and local governments, as well as private groups interested in preservation of cultural resources. It is used as a guide to identify the historic resources which have national, state, or local significance and in addition are deserving of preservation. Several criteria are used in the evaluation of sites. The major criteria are:

- that they are associated with events that have made a significant contribution to the broad patterns of our history;

- that they are associated with the lives of persons significant in our past;

- that they embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or

- that they have yielded or may be likely to yield information important in prehistory or history (National Register Bulletin #24, p. 5-6).

When the ordnance removal project begins, if a Forest Service recommendation cannot be followed, the Corps of Engineers will notify the Forest Service archaeologist to work out a compromise.

As the ordnance removal occurs, cultural resource sites may be identified. As items are excavated, photos will be taken to document the item in context with its surroundings. Location will be mapped. Complete descriptions, photographs, and locations (N/S and E/W coordinates, horizontal and vertical control) are critical to allow cost-effective and accurate assessment of the historic resources of the area. Information should be maintained to document:

- location of excavated pit;
- horizontal and vertical location of artifact;
- photos of artifact;
- sketch/photo of artifact;
- sketch of site area (i.e., site map);
- site form filled out and submitted to State Historic Preservation Office; and
- date and name of person(s) on crew who filled out the form.

All items except ordnance will be left in the ground. In the event of questions, an archaeologist will be contacted for guidance. If prehistoric artifacts are found, work will cease and the project archaeologist will be immediately notified.

Criteria which will help UXO contractors evaluate archaeological sites have been developed. The evaluation of each site may be dependent on some of these criteria and they should be used in conjunction with one another, not independently, to judge whether an archaeologist should be called. For example, under age, early sites may be judged more significant if they also fulfill conditions of good preservation and integrity. Likewise, a well-preserved site from the late prehistoric would be more significant than a disturbed early prehistoric site.

- Age: Early sites, both prehistoric and historic are more significant.

- Regional Interest: Sites which have an impact on regional and local research problems are more significant.

- National Interest: Sites which have an impact on national and universal problems are more significant.

- Preservation: Sites containing well-preserved remains are more significant.

- Degree of Erosion: Sites which exhibit smaller percentages of disturbance by erosion or development are more significant.

- Stratification: Well-stratified sites and dateable sites with several components are more significant.

- Size and Depth: Larger sites and those with deep deposits of cultural material are more significant.

- Uniqueness: Sites containing, or composed of, rare or unique features (burial mounds, ossuaries, early man sites) are more significant.

- Previous Knowledge: Site types about which little is known are more significant.

- Public Significance: Sites which may easily be used in public education programs due to site contents and accessibility for public viewing are more significant.

As a result of inclusion of mitigation plans in the ordnance removal procedure, the action will have a positive impact on cultural resources at the Dolly Sods Wilderness, in that those resources will be identified for future study.

6.3.1.7. Socioeconomic Resources

The socioeconomic impact of this alternative is difficult to calculate. Due to the limited data available regarding tourism, it cannot be predicted with accuracy whether: (1) the ordnance removal will inhibit use of the Dolly Sods Wilderness over the six month project period, and (2) to what degree the impact would be felt. From other projects of this nature, there have been both positive and negative impacts which negate each other. Negative impacts include loss of revenues from a few "tourists" that come to the area during clean-up that will leave or reduce their visitation time. Positive impacts could be realized during the clean-up from the jobs created from the clean-up activities. Therefore, although the net economic impact is unclear, it may be near zero.

In the longer term, the ordnance removal project will have a positive economic impact. With ordnance removed from trails and campsites, the United States Forest Service will be able to allocate its maintenance funds in a fashion that would otherwise not be possible. For example, with ordnance removed from trails and campsites, crews will be able to work on trail maintenance projects without attempting to locate ordnance first. Work will proceed more quickly, and therefore, limited funds for such activities will be stretched farther.

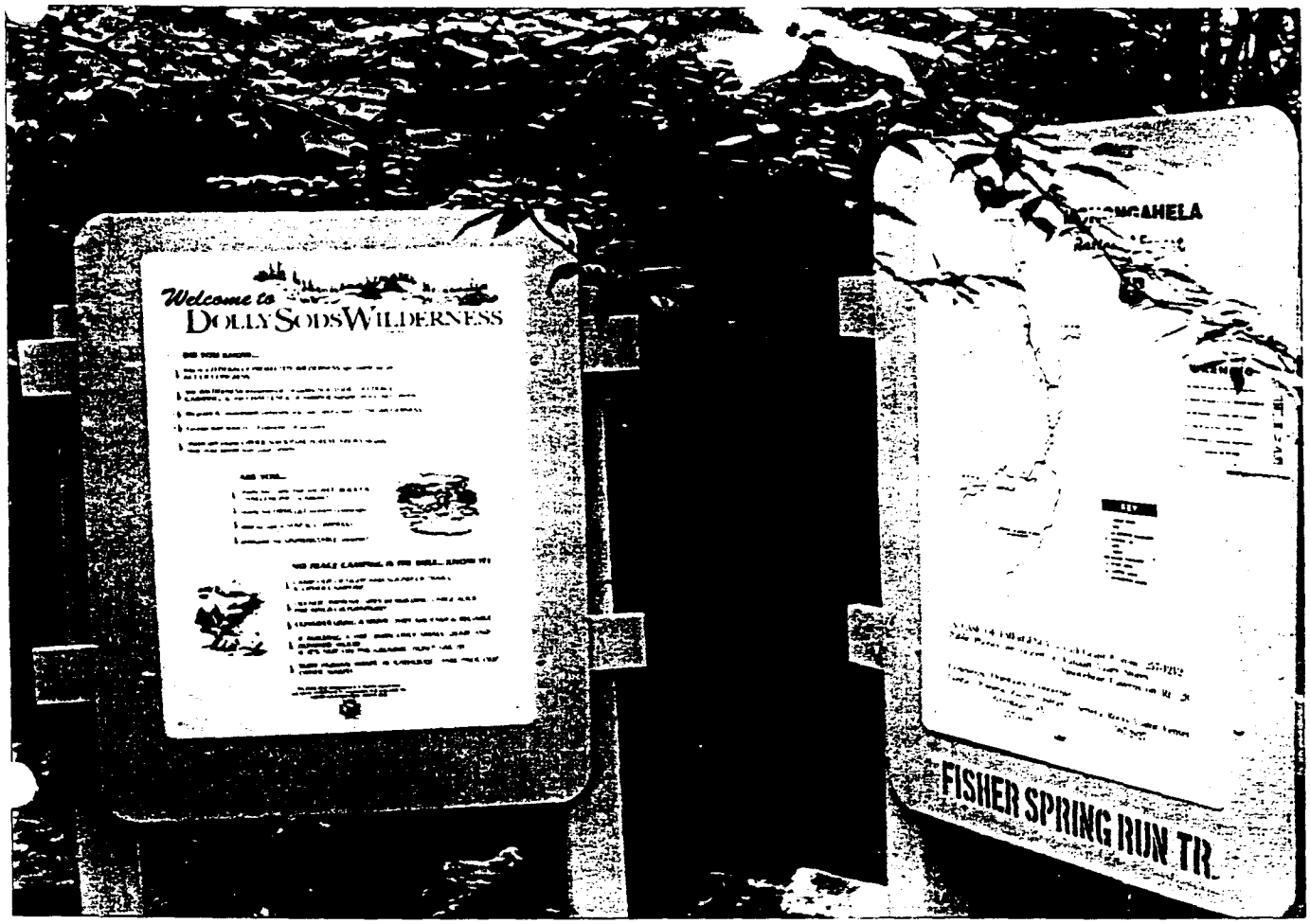

Figure 6-4. Signs posted at trail heads caution hikers about safety issues. Additional signs will be posted to notify visitors of the ordnance removal project.

6.3.1.8. Public Safety

The most intensive use of the Dolly Sods Wilderness is on trails and in campsites. Activities most likely to cause detonation of ordnance—digging, probing, and lighting fires—occur in campsites. A very high level of risk from unexploded ordnance is present for both hikers and hunters. While Alternative 2 allows creation of a risk-free corridor for hikers, it fails to provide safe resting places that are required by wilderness users.

The government has an obligation to reduce insidious risks. It is not feasible to reduce risk by closing camping areas because enforcement would be impossible given the number of camping areas, the multiple avenues of approach, and the diverse locations. Therefore, if campsites are not cleared of ordnance, the government has failed to provide a safe corridor for users.

6.4. Alternative 3—Environmental Consequences of No Action—Not searching for ordnance. Disposing of mortars and artillery shells that are found and reported by area users.

No action generally suggests a continuation of the status quo, however, it is not clear whether this is the case for the Dolly Sods Wilderness. The USDA Office of the Inspector General (OIG) has reviewed the situation, and has recommended that the wilderness area be closed to the public should ordnance not be removed. Jim Page, supervisor of the Monongahela National Forest, has taken issue with the recommendation, and contends that the area should remain open, with warnings posted. A final decision has yet to be reached. Since the Forest Service has not reached consensus about what course of action to take should ordnance not be removed, it is difficult to quantify environmental consequences. Both situations are addressed.

6.4.1. Direct and Indirect Effects and Their Significance; and Mitigation Measures

The wilderness ethic, "leave no trace," implies that man's use of wilderness areas should have little impact on the ecology of the area. Therefore, if man's use of the wilderness is restricted or banned, as could be the case if the no action alternative were selected, there should be no direct impact. In reality, however, man's use does show signs of wear at the Dolly Sods Wilderness, particularly at campsites and trails. If use were limited or banned, these areas would grow over with second generation cover. A summary of the impacts of Alternative 3 is shown in Table 6-7.

Several significant impacts to wilderness use would occur. First, the public would be deprived of the use of one of the most popular and accessible wilderness areas in the eastern United States. Secondly, the cost and logistics of closure would be formidable. It is questionable whether the wilderness area could actually be closed given the number of avenues of approach and difficulty in patrolling those avenues.

6.4.1.1. Botanical Resources

If the ordnance is not located and removed, and the area remains open, there would be no impact on botanical resources.

However, if a piece of ordnance were found by hikers, the Forest Service would follow current procedures and request that a UXO team detonate it in place. The impact of that detonation would be similar to that expected when UXO teams remediate the area.

If the Dolly Sods Wilderness were closed to the public, heavily used areas such as trails and campsites would not be maintained and would grow over with second generation cover.

Table 6-7
Summary of Environmental Consequences
Alternative 3—No Action

Resource	Effect	Mitigation Measures
Botanical	No direct effect	N/A
Zoological/Wildlife	No direct effect	N/A
Wilderness	Cost of trail maintenance may double since search for ordnance will be required prior to performing maintenance activities. Trail maintenance may be reduced, or other resources may be diverted to cover costs of signing. Dolly Sods Wilderness may be closed and the public will be deprived of a recreational resource. Negative impact.	N/A
Wetlands	No direct effect.	N/A
Environmental air/water/soils/noise	No direct effect	N/A
Cultural	No survey performed to identify potential sites of significance.	N/A
Socioeconomic	If wilderness area is closed to the public, an estimated 25,000 people would not travel to the area. Area economy will lose $1.9M in output, $730K in payroll, and lose 43 jobs. There would be higher maintenance and enforcement costs borne by the Forest Service.	N/A
Public Safety	Risk to the public would be maintained. This would be a negative impact.	N/A

6.4.1.2. Zoological Resources

If the ordnance is not located and removed, and the area remains open, there would be no impact on zoological resources.

However, if a piece of ordnance were found by hikers, the Forest Service would follow current procedures and request that a UXO team detonate it in place. The impact of that detonation would be similar to that expected when UXO teams remediate the area.

If the Dolly Sods Wilderness were closed to the public, zoological species currently hunted would gain in population. An evaluation of the effect of Alternative 3, no action, is presented in Table 6-8.

Table 6-8
Evaluation of Impact of Alternative 3 on Endangered, Threatened, and Sensitive Zoological Species

Common Name	Scientific Name	Impact of Alternative 3
ENDANGERED AND THREATENED		
Gray Wolf	*Canis lupus*	Since the gray wolf no longer occurs in West Virginia, no direct, indirect, or cumulative effects are anticipated from Alternative 3.
Eastern Cougar	*Felis concolor couguar*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
Virginia Big-Eared Bat	*Plecotus townsendii virginianus*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
Indiana Bat	*Myotis sodalis*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
Peregrine Falcon	*Falco peregrinus*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
Virginia Northern Flying Squirrel	*Glaucomys sabrinus fuscus*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
Bald Eagle	*Haliaeetus leucocephalus*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
Cheat Mountain Salamander	*Plethodon nettingi*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
SENSITIVE		
Southern Water Shrew	*Sorex palustris punctulatus*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
Cheat Minnow	*Rhinichthys bowersi*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
Green Salamander	*Aneides aeneus*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
Eastern Small-Footed Bat	*Myotis subulatus leibii*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
Allegheny Woodrat	*Neotoma floridana magister*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
Southern Rock Vole	*Microtus chrotorrhinus cardinensis*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
Northern Goshawk	*Accipiter gentilis*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
Cerulean Warbler	*Dendroica cerulea*	No direct, indirect or cumulative effects are anticipated from Alternative 3.
Appalachian Cottontail	*Sylvilagus obscurus*	This is the only confirmed occurrence of a sensitive species known within the project area. No direct, indirect or cumulative effects are anticipated from Alternative 3.

6.4.1.3. Wilderness Resources

Wilderness resources would be adversely impacted if ordnance were not removed. Wilderness resources would be impacted, because the cost of wilderness maintenance would be significantly increased. According to Nancy Feakes, the district ranger, the cost of trail maintenance, for example, would be more than doubled, as maintenance crews would first have to search areas with metal detectors and locate metallic materials to protect against unexploded ordnance. In a time of shrinking budgets, this would mean reduced trail maintenance. Resources would also have to be diverted to signing to warn visitors of danger from ordnance. This would further strain budgets. If the area were closed to the public, the cost of enforcing closure would also be significant.

6.4.1.4. Wetlands

If the ordnance is not located and removed, and the area remains open, there would be no impact on wetlands. If the area were closed to the public, there would be no impact on the wetlands.

However, if a piece of ordnance were found by hikers, the Forest Service would follow current procedures and request that a UXO team detonate it in place. The impact of that detonation would be similar to that expected when UXO teams remediate the area.

6.4.1.5. Environmental Resources

If the ordnance is not located and removed, and the area remains open, there would be no impact on air quality, water quality, soils or noise.

However, if a piece of ordnance were found by hikers, the Forest Service would follow current procedures and request that a UXO team detonate it in place. The impact of that detonation would be similar to that expected when UXO teams remediate the area.

If the area were closed to the public, there would be no impact on air, water, soil, or noise.

6.4.1.6. Cultural Resources

If the ordnance is not located and removed, and the area remains open, there is a potential negative impact on archaeological resources. Because the survey to locate sites would not be performed, they would not be protected. Environmental conditions and the public could damage the unprotected sites.

6.4.1.7. Socioeconomic Resources

If the no action alternative were to occur, i.e., if ordnance were not removed, the Forest Service has not yet determined their response for protection of public safety. The USDA Inspector General has recommended closure of the area to the public; forest superintendent Jim Page recommends that the area be left open and that more warning signs be erected. For the purpose of this Environmental Assessment, a worse-case scenario was developed, the impact of closure of the Dolly Sods Wilderness to the public.

The socioeconomic impact of the no action alternative is difficult to estimate using the available data. Neither the Forest Service nor the state of West Virginia has developed detailed, discrete data related to tourism at specific sites. Rather, the data collected addresses the impact of tourism in a larger area, of which the Dolly Sods Wilderness is one of over five active sites. Others include Seneca Rocks, Smoke Hole Caverns, and Spruce Knob.

Data used for the study is that which measures the economic impact of tourism on the Partnership for Progress Area III, and covers 10 counties and numerous tourist attractions including the Dolly Sods Wilderness. This data is the best available and was therefore used to derive an upper bound for the economic impact of this alternative.

Earnings for 1993 by industry and use patterns of several tourists attractions were used to deflate the economic impacts of the Partnership for Progress Area III. The ratio of earnings by place of work for tourism related industries in the four-county area surrounding the Dolly Sods Wilderness to earnings by place of work for tourism related industries in the Partnership for Progress Area III was used to deflate the economic impact down to the economic impact of all tourism in the four-county area surrounding the Dolly Sods Wilderness. The percent used was 50.5%. Estimates of use patterns for the Dolly Sods Wilderness and the National Recreation Areas were then used to deflate the economic impact down to the impact of closing the Dolly Sods Wilderness. According to Dave McMorran, assistant district ranger, an estimated 25,000 people would not travel to the area if the Dolly Sods Wilderness were closed. He also estimated that 500,000 people visit the National Recreation Areas located in the four-county area surrounding the Dolly Sods Wilderness. This estimate does not take into account the tourism activities at any tourism attraction except those in the National Recreation Area. Therefore, based on these estimates, the Dolly Sods Wilderness is believed to be responsible for less than 1/20th (25,000/500,000) of the four-county area. Therefore, a rough "upper bound" estimate of the economic impact of closing the Dolly Sods Wilderness is presented in Table 6-9.

Accordingly, it is estimated that if Alternative 3, closure of the Dolly Sods Wilderness, were to occur, it would impact the four-county area surrounding the Dolly Sods Wilderness as follows:

- less than a $1.9 million decrease in output
- less than 43 jobs will be lost, and
- less than a $730,000 decrease in payroll.

Table 6-9
Analysis of Impact of Closure

Category	Economic Impact of the Partnership for Progress Area III	Economic Impact of the four county area surrounding Dolly Sods (× 50.5%)	"Upper bound" estimate of the economic impact of closing Dolly Sods (× 1/20)
Output	$79.9 million	$38.7 million	$1.9 million
Employment	1,705	861	43
Payroll	$28.9 million	$14.6 million	$0.73 million

6.4.1.8. Public Safety

Unexploded ordnance at the Dolly Sods Wilderness presents an insidious risk to the public. The government has an obligation to reduce that risk. The methods to reduce are (1) to remove the ordnance from the area, or (2) to remove the public from the area.
Alternative 3, the No Action Alternative, requires removal of the public. Limited access, or no access, would be required. The cost and logistics of such an action would be formidable. It is questionable whether access to Dolly Sods could be limited, considering the number of avenues of approach and difficulty in patrolling the area. Unauthorized use by hunters and hikers could lead to discovery of ordnance and subsequent injury. It is concluded that by limiting access, the Forest Service will be doing little to reduce real risk.

Hikers and hunters following trails have found an average of two to three pieces of unexploded ordnance each year. More has surfaced as floods in recent years have caused shifting rocks and changes in creek beds. If findings from the 1991 feasibility study are extrapolated, between 5 and 30 pieces of ordnance may lie within the 105 acres to be searched. If ordnance were to explode, injury or death to wildlife and humans could result. Explosion could also lead to fire, and with restrictions on firefighting, significant impacts could result.

7.0 LIST OF PREPARERS

Name	Discipline
Nancy Vyas, M.S.E.	Environmental/Civil Engineering
Gloria Gozdzik, M.A.	Archaeology
William Grafton, M.S.F.	Forestry
Thomas Pauley, Ph.D.	Biology
Randall Childs, M.S.	Economics Bureau of Business Research
Laurie Morissette, M.A., J.D.	Environmental Law
Charles Bower, B.S.J.	Technical Writing and Documentation

8.0 BIBLIOGRAPHY

Adams, M. B., D. S. Nichols, C. A. Federer, K. F. Jensen, and H. Parrott. 1991. *Screening procedure to evaluate effects of air pollution on Eastern Region wildernesses cited as Class 1 air quality areas.* Gen. Tech. Report NE-151. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, 33 pp.

Adams, M. B., P. J. Edwards, F. Wood, and J. N. Kochenderfer. 1993. "Artificial watershed acidification on the Fernow Experimental Forest, USA." Journal of Hydrology, 150 (1993), 505-519 pp.

Baker, Michael, Jr., Inc. 1992. *Appalachian Corridor H: Supplemental Draft Environmental Impact Statement.* Corapolis, Pa.

Baker, Michael, Jr., Inc. 1992. *Appalachian Corridor H: Supplemental Draft Environmental Impact Statement-Appendices.* Corapolis, Pa.

Baker, Michael, Jr., Inc. 1992. *Appalachian Corridor H: Supplemental Draft Environmental Impact Statement. Natural Resources Technical Report, (Books I and II).* Corapolis, Pa.

Baker, Michael, Jr., Inc. 1992. *Appalachian Corridor H: Supplemental Draft Environmental Impact Statement. Historic and Archaeological Resources Technical Report.* Corapolis, Pa.

Brooks, Maurice. 1965. *The Appalachians.* Houghton Mifflin Co., Boston, Mass., 346 pp.

Core, Earl L. 1966. *Vegetation of West Virginia.* McClain Printing Co., Parsons, W. Va., 217 pp.

Edwards, P. J. and J. D. Helvey. 1991. "Long-term ionic increases from a central Appalachian forested watershed." Journal of Environmental Quality, 20(1), 250-255 pp.

Edwards, P. J. and F. Wood. 1992. "The effects of watershed acidification on soil water and stream water chemistry." *Proceedings of the 1992 Spring Meeting of the American Geophysical Union, Canadian Geophysical Union, and Mineralogical Society of America.* May 12-16, 1992. Montreal, Canada, 121 pp.

Kartesz, J. T. 1994. *A synonymized checklist of the vascular flora of the United States, Canada, and Greenland.* 2nd. ed. Volume I - Checklist. Timber Press, Portland, Oreg., 622 pp.

Kartesz, J. T. 1994. *A synonymized checklist of the vascular flora of the United States, Canada, and Greenland.* 2nd. ed. Volume II - Checklist. Timber Press, Portland, OR, 622 pp.

Lawrey, James D. 1993. *Lichen biomonitoring program in the Dolly Sods and Otter Creek Wildernesses of the Monongahela National Forest: A resurvey of lichen floristics and elemental status.* Final Report to the Forest Supervisor, Monongahela National Forest, USDA-Forest Service. George Mason University, Fairfax, Virginia, 112 pp.

McClung, Gordon W. and Rebecca L. Suter. 1992. *West Virginia Area III Partnership for Progress Travel and Tourism Economic Impacts—1991.* Bureau of Business Research, West Virginia University, Morgantown, W. Va.

McClung, Gordon W. and Rebecca L. Suter. 1993. *West Virginia Area III Partnership for Progress Travel and Tourism Economic Impacts—1992.* Bureau of Business Research, West Virginia University, Morgantown, W. Va.

McClung, Gordon W. and Rebecca L. Suter. 1993. *West Virginia Travel and Tourism Economic Impacts—1992.* Bureau of Business Research, West Virginia University, Morgantown, W. Va.

Metcalf & Eddy, Inc. 1991. *Feasibility Study Dolly Sods Wilderness Area: Final Work Plan for Surface and Subsurface Investigation and On-Site Disposal of Ordnance*, July 19, 1991, Wakefield, Mass.

Metcalf & Eddy, Inc. 1992. *Feasibility Study Dolly Sods Wilderness Area: Engineering Report for Extent of OEW Contamination and Evaluation of Remedial Action Alternatives*, January 21, 1992, Wakefield, Mass.

Price, Paul H., et al. 1938. *Geology and natural history of West Virginia.* Vol. 10, 462 pp. 1938, West Virginia Geological and Economic Survey, Morgantown, W. Va., 462 pp.

Stephenson, Steven L. (ed.). 1993. *Upland forests of West Virginia.* 1993, McClain Printing Co., Parsons, W. Va.

Strausbaugh, P. D. and E. L. Core. 1977. *Flora of West Virginia*, 2nd ed. Seneca Books, Inc., Grantsville, W. Va., 1,079 pp.

U.S. Department of Commerce. 1995. "Regional Economic Information System." (on CD-ROM) Bureau of Economic Analysis, Washington, D.C.

U.S. Fish and Wildlife Service. 1990. "Appalachian Northern Flying Squirrel Recovery Plan." Newton Corner, Mass., 51 pp.

U.S. Fish and Wildlife Service. 1991. "Cheat Mountain Salamander Recovery Plan." Newton Corner, Mass., 35 pp.

Venable, Norma Jean. n.d. *Dolly Sods*. West Virginia University Extension Service, Morgantown, W. Va., 24 pp.

Whisman, Steven Andrew. 1990. "Administrative and Visitor Costs in Selecting a Wilderness Use Monitoring System." M.S. Thesis, West Virginia University, Morgantown, W. Va.

W. Va. Bureau of Employment Programs. 1995. *West Virginia Economic Survey*: A Monthly Newsletter on Economic Activity in West Virginia. (June) Labor and Economic Research Division, Charleston, W. Va.

W. Va. Highlands Conservancy (Wilderness Committee). 1973. *The Dolly Sods Area—32,000 Acres in and Adjacent to the Monongahela National Forest. Part I—Wilderness Proposal and Management Suggestions; Part II—Trail Guide*. 4th ed., Rev. Charleston, W. Va.

W. Va. University Center of Economic Research. 1988. *West Virginia Business and Economic Review*. (Winter & Spring eds.) College of Business and Economics, Morgantown, W. Va.

9.0 APPENDIX

APPENDIX I

Record of Public Response

A. List of Coordination Meetings with Public and Resource Agencies.

B. Response Letters to Public Notice (9 letters).

C. Response Letters to Draft Environmental Assessment (3 letters).

D. Minutes of Informational Meeting, August 16, 1995.

Table I-A
List of Coordination Meetings with Public and Resource Agencies

Date	Contact & Title	Purpose of Discussion
4/3/95-4/4/95	Lynn Frow U.S. Army Corps of Engineers Huntsville Division	Coordination meeting to prepare scoping letter.
4/3/95-4/4/95	Barry Passmore U.S. Army Corps of Engineers Huntington District	Coordination meeting to prepare scoping letter.
4/3/95-4/4/95	Wayne Budrus U.S. Army Corps of Engineers Huntington District	Coordination meeting to prepare scoping letter.
4/3/95-4/4/95	Wallace Dean U.S. Army Corps of Engineers Huntington District	Coordination meeting to prepare scoping letter.
4/3/95-4/4/95	Ellis Gilliand U.S. Army Corps of Engineers Huntsville Division	Coordination meeting to prepare scoping letter.
4/3/95-4/4/95	Nancy Feakes, Potomac Ranger District Monongahela National Forest Ranger USDA Forest Service	Coordination meeting to prepare scoping letter.
5/10/95	William Grafton WVU Extension Service Expert on Flora and Fauna at Dolly Sods	Requested review of ordnance location and disposal plan as it affects flora and fauna.
5/10/95	Jim Kotcon, President, WV Sierra Club (304) 594-3322	Obtained list of concerns generated by 4/7/95 public notice.
5/10/95	John Benedict, Asst. Chief WV DEP Air Quality	Obtained list of concerns generated by 4/7/95 public notice.
5/11/95	Fred McEvoy Archaeologist WV Historic Preservation Office (304) 558-0220	Reviewed files and maps to determine no existing historical preservation sites.
5/11/95	John Benedict, Asst. Chief, DEP Office of Air Quality (304) 558-4022	Discussed planned ordnance demolition at Dolly Sods. No air quality concerns.
5/11/95	Lyle Bennett, Asst. Chief DEP Water Quality (304) 558-2108	Obtained list of questions and concerns generated by 4/7/95 public notice.
5/11/95	Barbara Taylor DEP Water Quality Env. Review (304) 256-6850	Obtained list of questions and concerns generated by 4/7/95 public notice.

Table I-A
Coordination Meetings with Public and Resource Agencies
(Continued)

Date	Contact & Title	Purpose of Discussion
5/11/95	Norm Steenstra Citizens Action Group (304) 594-3322	Obtained list of questions and concerns generated by 4/7/95 public notice.
5/17/95	Hunter Lesser Archaeologist, USDA Forest Service	Solicit Technical Information & listen to concerns for integration into EA process
5/17/95	Harry Pawelczyk Biologist, USDA Forest Service	Solicit Technical Information & listen to concerns for integration into EA process
5/17/95	William Tolin US Fish & Wildlife Service	Solicit Technical Information & listen to concerns for integration into EA process
5/18/95	Barbara Sargent, Biologist WV Dept. of Natural Resources	Solicit Technical Information & listen to concerns for integration into EA process
5/18/95	P.J. Harmon, Biologist WV Dept. of Natural Resources	Solicit Technical Information & listen to concerns for integration into EA process
5/18/95	Walter Lesser Wildlife Biologist WV Dept. of Natural Resources	Solicit Technical Information & listen to concerns for integration into EA process
5/18/95	Dave McMorran, Potomac Ranger District Monongahela National Forest Ranger USDA Forest Service	Solicit Technical Information & listen to concerns for integration into EA process
5/18/95	Sara Schell, USDA Forest Service	Solicit Technical Information & listen to concerns for integration into EA process
5/24/95	Allen Glasscock, Wildlife Biologist WV Dept. of Natural Resources	Solicit Technical Information & listen to concerns for integration into EA process
5/24/95	Mary Wimmer WV Sierra Club	Provide detailed information about planned project & listen to concerns
5/24/95	Bill Potter WV Sierra Club	Provide detailed information about planned project & listen to concerns
5/24/95	Rick Landenberger WV Sierra Club	Provide detailed information about planned project & listen to concerns
5/24/95	Joe Robles USDA Forest Service	Solicit Technical Information & listen to concerns for integration into EA process
5/24/95	Nancy Feakes, Potomac Ranger District Monongahela National Forest Ranger USDA Forest Service	Solicit Technical Information & listen to concerns for integration into EA process
8/16/95	Nancy Vyas New-Bold Enterprises	Responded to information/presentation meeting to discuss Dolly Sods Wilderness Ordnance Removal Project.

Table I-A
Coordination Meetings with Public and Resource Agencies
(Continued)

Date	Contact & Title	Purpose of Discussion
8/16/95	Keith Peters Brooks Bird Club	Responded to information/presentation meeting to discuss Dolly Sods Wilderness Ordnance Removal Project.
8/16/95	Eric Fout Ohio Valley Environmental Coalition	Responded to information/presentation meeting to discuss Dolly Sods Wilderness Ordnance Removal Project.
8/16/95	Janet Fout Ohio Valley Environmental Coalition & Huntington Audubon	Responded to information/presentation meeting to discuss Dolly Sods Wilderness Ordnance Removal Project.
8/16/95	Leon Wilson Brooks Bird Club -Audubon	Responded to information/presentation meeting to discuss Dolly Sods Wilderness Ordnance Removal Project.
8/16/95	Jack Waldeck Audubon	Responded to information/presentation meeting to discuss Dolly Sods Wilderness Ordnance Removal Project.
8/16/95	James Williamson Audubon	Responded to information/presentation meeting to discuss Dolly Sods Wilderness Ordnance Removal Project.
8/16/95	Kauskik Vyas Nancy Hurst & Associates	Responded to information/presentation meeting to discuss Dolly Sods Wilderness Ordnance Removal Project.
8/16/95	Dr. Tom Pauley Marshall University	Responded to information/presentation meeting to discuss Dolly Sods Wilderness Ordnance Removal Project.
8/16/95	Mike Forman Vice President Huntingon Audubon	Responded to information/presentation meeting to discuss Dolly Sods Wilderness Ordnance Removal Project.
8/16/95	Mike Forman Vice President Huntingon Audubon	Responded to information/presentation meeting to discuss Dolly Sods Wilderness Ordnance Removal Project.
8/16/95	Laura Forman Treasurer Huntington Audubon & Ohio Valley Environmental Coalition	Responded to information/presentation meeting to discuss Dolly Sods Wilderness Ordnance Removal Project.
8/16/95	Wallace Dean U.S. Army Corps of Engineers	Responded to information/presentation meeting to discuss Dolly Sods Wilderness Ordnance Removal Project.
8/16/95	Ben Borda U.S. Army Corps of Engineers	Responded to information/presentation meeting to discuss Dolly Sods Wilderness Ordnance Removal Project.

ATTN: CEORH-PD-O A. B. Bonda JR.
ATTN: James Eutsman

Subject - Do 1/2 Sods Ordinance Removal

I favor alternate 1 page 2 - no action:

This is a waste of tax payer money: If searching 281 acres that are favorable places for finding shells & only 13 pieces, or 1 piece in 21 1/2 acres or 1 piece in 10 football fields was found, this project is like looking for a needle in a haystack.

If this project must proceed, then use National Guards or Corp of Engineers on their summer camp to do this work.

If it will help to stop this boon doggle, send me a letter telling me who to write or Call,

Sincerely
Charles Piercy
P.O. Box 100
Kingmont, WV 26578
304-376-4358

AMERICAN DISCOVERY TRAIL

A Project of The American Hiking Society
P.O. Box 20160
Washington, D.C. 20041

April 21, 1995

Commander
U.S. Army Corps of Engineers
ATTN: CEORH-PD-B (mr. A. B. Borda, Jr.)
502 Eighth St
Huntington, WV 25701-5712

Gentlemen:

I am writing in support of the proposal to search for and clear unexploded ordnance from the trails and campsites in the Dolly Sods Wilderness.

The American Discovery Trail is a newly developing 6,300 mile hiking trail that will extend from the Atlantic Ocean at Delaware to the Pacific Ocean in California. The route through West Virginia includes the Dolly Sods Wilderness in the Monogohela National Forest. At this time it is impossible to estimate the number of people who will use the ADT, but surely it will cause an increase in the use of the trails and campsites in Dolly Sods.

The Tidewater Appalachian Trail Club is a 600 member nonprofit organization that offers hiking trips for its members. Several trips each year are to the Dolly Sods area. It is a premier location for hiking and camping.

Thank you for the opportunity to comment on this proposal.

Happy and safe hiking,

Reese F. Luke, Jr.
ADT National Coordinator

cc: American Hiking Society
Tidewater Appalachian Trail Club

1046 Azalea Court, Virginia Beach, VA 23452 / 1-800-851-3442 FAX: 804-498-7282

(1145)

To Whom It May Concern, April 14th 1995

I am writing to express my opinion of "Destroying" Dolly Sods. (Dominion Post Article 4/13/95

folks, those mountains have been there for years + are admired by young + old from all places of the earth. They are Gods majestic mountains. Therefore, they should not be tampered with. There is another alternative if those "Bombs" have been there since WWII why bother them now. And if they must be removed, for Gods sake, blow them up some place else, don't destroy the land. My God people, think before you do this. If you were an animal, would you want your home totally gone? Im not being mean, just common. Grandpap always said, why try to fix some thing when its not broke.

Please feel free to call or write.

Yours truly
Shonna Eagle
640 Independence Hill
Morgantown WV 26505
(H) (304) 599-3126

Mountain Club of Maryland
Baltimore

5107 Leeds Ave.
Balto, MD 21227

April 24, 1995

Commander
U.S. Army Corps of Engineers
502 Eighth St.
Huntington, WV 25701-2070

Attn: Mr. A. B. Borda Jr.

Dear Sir:

This is a response to your circular of April 7th regarding removal of residual explosive materials from Dolly Sods, in which you propose a specific prodecure and refer to two alternatives. We are glad that hiking and camping groups such as ours are being asked to respond to this proposal.

Since there is a known hazard present, clearly we do not endorse the alternative of just leaving things as they are, even with perhaps simply posting warning notices, nor do we want to see access to the area restricted because of this situation.

As between the proposed solution and a more limited operation confined to designated trails with a short distance on each side of them, we believe that if any effort is to be expended, it should be an inclusive one such as you have proposed. The specifications that you cite seem sensible and seem not to be excessively detrimental to the natural environment. We hope that the operation will be conducted modestly and with minimal environmental disruption - as befits a designated Wilderness Area.

Sincerely yours,

Thurston Griggs
Conservation Chpsn.

cc's: ATC
PATC
Pres. Mowll
Dorothy Guy

P. O. Box 650
Great Falls, VA 22066
27 April 1995

Commander
U. S. Army Corps of Engineers
ATTN: CEORH-PD-B (Mr. A. B. Borda, Jr.)
502 Eighth Street
Huntington, WV 25701-2070

Dear Sir:

This letter is in response to your request for comments on the proposed Dolly Sods Wilderness, Ordnance Removal Project. I have been visiting the area for hiking and backpacking since 1979, having made over 25 trips of typically 3 days duration. Most of the trips involved leading my Boy Scout Troop in a wilderness backpacking experience. I also led several GAO staffers on a tour of Dolly Sods during their investigation of U. S. Forest Service management of wilderness areas.

I have read your proposal with some care, and I have a number of concerns. First, let me state that I am in agreement in principle that something probably should be done about the unexploded ordnance problem.

The first problem is that you do not state what the false alarm rate was in your 1991 feasibility study. The Dolly Sods area is full of metal artifacts from the earlier logging days. It seems likely that we will wind up with a wilderness full of holes - mostly due to false alarms. My second concern is that more attention needs to be given to how disturbed areas will be treated. The phrase "covered with leaves and other materials found in the area" is insufficient to provide assurance that an area receiving as much rainfall as Dolly Sods will be adequately protected by this undetailed procedure. Third, the proposal does not cover a search of Red Creek and other riparian areas. Much leisure activity in Dolly Sods is conducted along the banks or in the water of the streams, along with such necessities as getting drinking water. Continuing erosion and stream shifting may well uncover additional ordnance. Fourth, there are many "unofficial" trails in the area that receive a high degree of usage. Should

plans be made for their examination also? Fifth, the plans to explode the ordnance in place makes good safety sense. I think you should provide a clear indication as to how much impact this practice will have. I expect this practice to require additional ordnance for detonation. How big a hole might we expect on the average and at the largest extent?

I thank you for the opportunity to comment on this proposal. One small bit of housekeeping needs to be addressed. The letter I received was addressed to Walter Leggett, PO Box 195, Great Falls, VA 22066. My correct name is Robert Leggett and my address is as given above (recently changed from the address you had).

Sincerely,

Robert Leggett

.cc American Hiking Society
.cc Reese Lukei, National Coordinator, American Discovery Trail
.cc Lu Schrader, West Virginia Coordinator, American Discovery Trail

STATE OF WEST VIRGINIA
BUREAU OF COMMERCE
DIVISION OF NATURAL RESOURCES
OPERATIONS CENTER
P.O. BOX 67
Elkins, West Virginia 26241-0067
Telephone (304) 637-0245 Fax (304) 637-0250

GASTON CAPERTON
Governor

CHARLES B. FELTON, JR
Director

May 1, 1995

Mr. A.B. Borda, Jr.
U.S. Army Corps of Engineers
502 Eighth Street
Huntington, WV 25701-2070

Dear Mr. Borda:

Thank you for contacting the West Virginia Division of Natural Resources' Natural Heritage Program in regards to your Ordnance Removal Project in the Dolly Sods Wilderness. As Dolly Sods is such a unique area with many rare, threatened and endangered species, the Natural Heritage Program would like to be kept abreast of this project.

We would like to be given the opportunity to review the proposal for impacts to rare, threatened and endangered (RTE) species. If you have any questions please call me.

Thank you again for the opportunity to comment.

Sincerely,

Barbara Sargent

Barbara Sargent
Environmental Resources Specialist
Natural Heritage Program
Wildlife Resources Section

361 Laurel St.
Morgantown, WV 26505

James S. Everman
U.S. Army Corps of Engineers
ATTN: CEORH-PD-B (Mr. A.B. Borda, Jr.)
502 Eighth St.
Huntington, WV 25701-2070

Dear Mr. Everman/Mr. Borda:

I am responding to your April 7 request for input concerning the Ordinance Removal Project proposed for the Dolly Sods Wilderness Area. I realize that you desired comments by April 28, but I was unable to respond until now. I understand that you are preparing an Environmental Assessment for this project, and I assume that this is your initial scoping letter to identify issues to address in that document.

I have been a user of Dolly Sods Wilderness for the past 15 years. I hike and backpack there, and have been on every mile of trail; I have done many hours of trail maintenance work on its trail system; I was on the interdisciplinary team that worked on a future management plan for this Wilderness; and I was deeply involved in keeping the military out and away from this special area when they were looking to expand their training on our Monongahela National Forest several years ago. I own land 2 miles east of Dolly Sods. Therefore, I have a strong and abiding interest in protecting this Wilderness Area from disturbance and damage.

Your proposal to remove ordinance from this heavily used area has merit, although one wonders why it has taken 50 years (!) to address the problem. Doing trail work after the 1985 flood, I can appreciate the dilemma, as we dug debris with pulaskis not far from a downed tree containing an unexploded shell which was later detonated.

I do have the following concerns which I recommend be addressed in your Environmental Assessment:

1. Wilderness ethic says we "leave no trace." Your environmental assessment should describe the Wilderness Act so we see that you understand the dramatic shift in wilderness value since WWII, and should focus on how you plan to carry out your project with this directive in mind.

2. Your earlier feasibility project should be described in detail, including the after affects and what was learned. What were the impacts, not only from the digging, but especially from the detonating of active shells? What size area is destroyed when the shells are detonated? Is there a crater left, and how large/deep? How will these impacts be mitigated?

3. What site restoration will be done after the work? Simply covering with leaves will not prevent soil erosion or enhance revegetation, expecially on steep slopes. Will

esp. in view of current locations of campsites / trails { Stream bank protection Prevention of stream sedimentation

native soils be used to fill craters, and native species used to revegetate a site, both with the advice and supervision of U.S. Forest Service ecologists and soil experts?

4. Your alternatives are very limited. One in which you clear hiking trails to less width (5-10 ft.) on each side plus campsites should be considered to minimize impacts. And an alternative that cover all of the Sods should be developed as wilderness users could disperse anywhere.

5. How will your project address the proposed dispersal of campsites being considered as the Forest Service continues to work on how this overused Wilderness will be managed in the future to lower human impacts? Perhaps your problem would be a good reason for the Forest Service to begin a registration system in the Wilderness to lower the overuse, with your efforts focused on designated camping areas and trails.

6. A Forest Service person trained in Wilderness management MUST, in my mind, be present to monitor and supervise all work done. You say you will "train" your UXO to recognize and avoid endangered species. I don't believe this is possible. (Why would I trust the military in view of the billions of dollars of environmental damage they have done all over the world, and especially here at home? Sorry. The damage even extends into the Mon National Forest.)

7. You are correct when you say how slow revegetation occurs in the Dolly Sods environment. Again, you say the UXO team will be "trained" how to minimize impacts to plant life. The word "minimize" depends on your perception, and I do not believe the military perception is at all related to "leave no trace" unless it is in regard to avoiding the "enemy." I reiterate the need for Forest Service supervision.

8. I strongly support not using motorized vehicles and using hand digging.

9. What time of year will this be done, and over how long a period? How will users be notified, since I assume they will be restricted from the work areas? Will the area be cordoned off, and how will this be done with the "leave no trace" directive?

These are my initial comments on your proposal. I will certainly want to evaluate and provide input on a draft environmental assessment for this project, so please send when one is available. Meanwhile, if I can be a sounding board as your ideas develop, you can reach me during the day at 293-7758. I also request that the EA and other communiques be sent to Dr. Steve Hollenhorst, WVU Division of Forestry, Morgantown, WV 26506-6125; phone 293-3721x2441 and sent to Dr. Tina Hall of the Nature Conservancy in Charleston both of whom have done studies involving Dolly Sods.

Sincerely,

Mary J. Wimmer

Mary J. Wimmer
WV Sierra Club Forest Watch

cc: Jim Page, Jill Shoemaker, Steve Hollenhorst, Tina Hall

April 28, 1995

1507 Barrett Road
Baltimore, MD 21207-4970

Commander
U.S. Army Corps of Engineers
ATTN: CEORH-PD-B (Mr. A.B. Borda, Jr.)
502 Eighth Street
Huntington, WV 25701-2070

Dear Commander:

Thank you for the April 7, 1995 letter from James S. Everman notifying me of the planned Ordnance Removal Project at the Dolly Sods Wilderness Area, WV.

First, I would like to receive additional information on this project including a copy of the Environmental Assessment, etc. Please keep me informed of the project as it progresses.

Second, Mr. Everman's letter has raised several questions and comments to which I would appreciate a reply. These concerns have been outlined below.

1. What type of ordnance was found during the 1991 feasibility study? Was it live? Was it detonated, either purposely or not, on site? Did any injuries result? What sort of ordnance do you expect to find during the ordnance removal project?

   What sort of ordnance has been found and reported by hikers and campers? When? Was it live? Was it detonated, either purposely or not, on site? Did any injuries result?

2. What has prompted the Department of the Army to carry out this project now, 4 years after the 1991 feasibility study? Has a risk assessment or cost-benefit analysis been performed?

3. When will the decision be made to go with either the proposed action (search 20' corridor on each side of trails and all campsites, excavate trails to 1' and campsites to 4') or an alternative (either no action or search 20' corridor on each side of trails and excavate trails to 1' with no search or excavation of campsites)?

   First, the requirement to search trails 20' on each side should be waived and the distance lessened to 10' for those areas of the trail that are bordered by steep slopes which effectively confine the hiker to the trail, i.e., certain portions of the Rocky Point Trail, Fisher Spring Run Trail, and Red Creek Trail, among others.

   Everman's letter does not mention site restoration other than to mention covering the area with leaves. This approach is

inadequate. Is this the extent of the plans to restore any disturbed areas of the trails? Full site restoration to its natural condition should be done for any disturbed area, including trails. Plans to accomplish this need to be specifically laid out. This will ensure that trails (and campsites) remain usable and the quality of the wilderness experience is preserved.

Second, although I support searching and excavating campsites, I do not support excavating them to a 4' depth for several reasons. An excavation this deep is almost certainly unnecessary to protect against most risks, especially considering that one of the alternatives being considered is to not search or excavate campsites at all. A 4' excavation will also be more likely to contribute to sedimentation and decreased water quality. A 4' excavation will also be almost impossible to restore as a campsite. An excavation to 1' should be sufficient. Additionally, full site restoration to its natural condition should be done for any disturbed campsite. This will ensure that campsites remain usable and the quality of the wilderness experience is preserved.

4. When will the Ordnance Removal Project take place? It should take place outside of the early May through mid-September period when frontcountry and backcountry use of the Dolly Sods is at its highest. Additionally, activities should take place during the week when use is lower.

5. Who will be performing the Ordnance Removal Project? Will it be done by the Army Corps of Engineers or a private contractor? (Everman's letter referred to a "UXO contractor.") Will the same contractor be used through all phases? How much will each phase and the total project cost? Or, in the alternative, how much has been allocated? What budget will this money be drawn from?

6. What procedures for searching, excavating, and detonating UXO will be followed for streambeds? All of the trails in Dolly Sods cross one or more of the streams and creeks. Portions of the streams and creeks will also be included under the "20 feet to each side" trail search area; even more of the streams and creeks will be included if the campsites are searched since many of these are located on the creeks and streams. I would recommend that no excavation or detonation activities take place within 20' of any watercourse because of the potential for adversely altering the stream channel and negatively affecting water quality.

7. What measures will be taken to guard against erosion and sedimentation of streams and creeks before, during, and after excavation and any necessary detonation activities? Stream

quality should be of paramount importance throughout this project. Siltation fences, etc. should be used to ensure that erosion and sedimentation of the streams does not occur. Site restoration to its natural condition will also guard against adverse water quality impacts.

8. You noted that all excavation will be by hand. What types of tools will be used? Will any of them be motorized? Will chainsaws be used?

9. How may I get a copy of the documentation of the 20.8 miles of trails and 101 campsites which you have noted that the Forest Service has identified?

10. All areas that have been excavated should be back-filled with the earth and other material that was removed from them. Simply trying to cover them with leaves will not be enough.

    As noted earlier, full site restoration to its natural conditions should be done to protect the habitat disturbed, to ensure future usability of campsites, and to preserve the wilderness experience.

11. Trees should not be cut down to carry out this project.

12. What is the rate of error on the equipment you plan to use? That is, what percentage of the time will it identify that there is ordnance present when there really is not? What other substances are likely to give a false positive reading? (e.g., metal deposits in rocks, buried food cans, old shells that have already been detonated, etc.)

Thank you for your cooperation in responding to these issues. I look forward to your reply. Please also keep me informed of the progress of this project as I have requested above.

If you need to contact me about these comments, you may reach me at (410) 631-3260 (work) or (410) 788-9956 (home).

Sincerely,

Dorothy M. Guy

Dorothy M. Guy

Potomac Headwaters
Resource Conservation and Development Region, Inc.
Established 1969

1446-2 Edwin Miller Boulevard
Martinsburg, WV 25401-3737
(304) 267-8953

"RC & D . . . making things happen"

April 14, 1995

Commander
US Army Corps of Engineers
502 Eighth St
Huntington, WV 25701-2070

Attention: CEORH-PD-B (Mr. A.B. Borda, Jr.)

Dear Sir:

I have reviewed your Ordnance Removal Project proposal on behalf of the RC&D Council.

I find no reason to object, as I feel the action is necessary to maintain public safety.

Very truly yours,

Roger Boyer
Coordinator

August 21, 1995

Wally Dean
U.S. Army Corps of Engineers
Huntington District
502 8th Street
Huntington, WV 25701-2070

Re: Dolly Sods Wilderness Ordnance Removal

Dear Mr. Dean,

On August 16, 1995, I attended a meeting about the proposed action to remove ordnance from the Dolly Sods Wilderness area. Even after the presentation, I still had many unanswered questions. No one could tell me if this action will ever have to be repeated. No one could give an exact amount of money that is to be allotted to this action, and I still do not understand the necessity of the ordnance removal. It seems that the main consideration is being given to the people that visit the sods.

Since the Dolly Sods area is being adversely affected by people already, I suggest that the Corps take no ordnance action and preserve the area for its indigenous inhabitants, (the flora and fauna). I am aware this could mean the closure of the area to human visitors, and I will of course miss my trips to the Sods, but am willing to find other wild areas to enjoy in order that the beauty and serenity of the Sods be left unspoiled.

Sincerely,

Laura J. Farman
2233 Rt. 75
Renovo, WV 25530
453-2301

JAMES R WILLIAMSON
4224 PIEDMONT RD
HUNTINGTON, WV 25704-1831

Mr.Borda;

Concerning the Dolly Sods Wilderness ordnance removal project, Confining the blast assesment to the size of the crater area is wrong. You may want to study in detail after the first blast, the flora and fauna and then determine the blast impact area in relation to size shell exploded.

I would set off a fire cracker type charge near the detonation hole, wait a minute and sound the horn and blow the main charge. Hopefully, this would give any creature in the area time to fly away or go to ground before the main blast.

Yours truly,

James R. Williamson

21 August 1995

Mr. Ben Borda
U.S. Army Corps of Engineers
Huntington District
529 Eighth Street
Huntington, WV 25701

Re: Dolly Sods Wilderness Ordnance Removal Project

Dear Ben:

Thank you for arranging to have the USACOE consultant speak at a meeting in Huntington to citizens interested in the ordnance removal project planned for Dolly Sods.

As private citizens (not on behalf of any group), it is our belief that the Corps should choose a "no action" alternative. Wilderness is not just for people. We concur with other agencies that have expressed the opinion that the Dolly Sods Wilderness Area is overused and should be closed to the public. With so many people visiting Dolly Sods (especially on weekends), much of what we consider to be wilderness values have been lost. While people could be at risk from unexploded ordnance, the flora and fauna are already suffering. As much as we love Dolly Sods, the intrinsic wilderness values of the place should come before our own needs.

Since the money for the project has come to the Corps via CERCLA, we suggest that it be spent in a way that directly affects people--cleaning up a Superfund site that places people in a low income area at imminent risk. The Corps shouldn't have any difficulty in finding a place to spend the money. When CERCLA was enacted in 1980 and signed into law by President Jimmy Carter, there were over 30,000 abandoned toxic-waste sites in the United States--an average of 600 per state in the lower 48 (Mark Dowie, 1995, Losing Ground, MIT, Cambridge, MS).

Because of unique scientific values of the area, scientists who wish to continue research at Dolly Sods should be given permits to study the area.

Thank you for the opportunity to comment.

Sincerely,

Janet Fout
126 Shockey Drive
Huntington, WV 25701
522-7957

Eric Fout

Meeting Notes
August 16, 1995
Huntington, WV, Public Library

Informational Meeting in Response to Request from
Mid-Ohio Valley Environmental Coalition

The meeting was held in response to a request from the Mid-Ohio Valley Environmental Coalition. The purpose of the meeting was to provide information about the planned project to remove ordnance from trials and campsites at the Dolly Sods Wilderness.

A project summary was presented by Nancy Vyas of New-Bold Enterprises. Vyas is the principal author of the Dolly Sods Ordnance Removal Project Environmental Assessment. A list of meeting attendees is included as Attachment 1. Text of information presented accompanying a slide presentation is included as Attachment 2. Also included is the handout provided.

Although the meeting was recorded, a transcript was not prepared. Instead, questions and comments have been summarized:

Q: How many holes will be dug?
A: Extrapolating from the feasibility study in 1991, up to 201 holes may be dug.

Q: Will Dr. Pauley be involved in the project as the biologist searching for the Cheat Mountain Salamander?
A: If not Dr. Pauley, a qualified biologist will perform the search.

Q: What will be the impact of concussions on wildlife and birds?
A: There is no anticipated impact as the open area will disperse concussive forces.

Q: How many UXO technicians will be working at Dolly Sods? How many teams? Will there be a biologist on each team?
A: That information will be available next spring when the contractor presents the project plan. It is anticipated that work will be conducted as it was during the feasibility study, with a few teams working at a time. There will be one biologist who will provide support to all teams.

Q: Why is the work being conducted now? What is the cost of the ordnance removal?
A: The project is one of many similar projects on a list awaiting funding. Funding has been received. The cost of ordnance removal is not know by the team that completed the NEPA review. That information can be obtained from the Corps of Engineers, Huntsville Division.

Comments:

- Digging 4 feet deep holes in campgrounds is too deep.
- The impact on all organisms in the Dolly Sods Wilderness, rather than only threatened, endangered, and rare species, should have been assessed.
- The deer population is declining in the Dolly Sods Wilderness.
- The ordnance removal may disturb some nesting birds.

Attachment 1

List of Attendees
August 16, 1995
Huntington, WV, Public Library

Informational Meeting in Response to Request from
Mid-Ohio Valley Environmental Coalition

	Name	Affiliation	Phone Number
1.	Nancy Vyas	New-Bold Enterprises	(301) 983-1893; (304) 292-7752
2.	Keith Peters	Brooks Bird Club	(804) 846-1222
3.	Eric Fout	Ohio Valley Environmental Coalition	(304) 522-7557
4.	Janet Fout	Ohio Valley Environmental Coalition & Huntington Audubon	(304) 522-7557
5.	Leon Wilson	Brooks Bird Club - Audubon	(304) 743-4013
6.	Jack Waldeck	Audubon	(304) 736-6356
7.	James Williamson	Audubon	(304) 429-2145
8.	Kauskik Vyas	Nancy Hurst & Associates	(301) 983-1896
9.	Tom Pauley	Marshall University	(304) 736-7687
10.	Mike Forman	Vice President Huntingon Audubon	(304) 453-2301
11.	Laura Forman	Treasurer Huntington Audubon & Ohio Valley Environmental Coalition	(304) 453-2301
12.	Wallace Dean	U.S. Army Corps of Engineers	(304) 529-5712
13.	Ben Borda	U.S. Army Corps of Engineers	(304) 529-5712

Attachment 2

Slide 1 Introduction (Cover)

The U.S. Army Corps of Engineers, Huntington District, completed an Environmental Assessment to determine the impact of ordnance removal from the Dolly Sods Wilderness. The purpose of this presentation is to provide an overview of the project. Since you have a high level of technical expertise, you no doubt will have questions or comments as we proceed. Please feel free to interrupt at will.

The Dolly Sods Wilderness is part of the Monongahela National Forest. It is a federally designated wilderness area and as such, is afforded special protection.

We developed a project team of scientists and engineers who are nationally-recognized experts in issues related to the Dolly Sods Wilderness:

- Dr. Tom Pauley reviewed zoological issues;
- Bill Grafton reviewed botanical issues;
- Steve Hollenhorst provided data and input related to recreation and wilderness protection;
- Gloria Gozdzik, an archaeologist active in West Virginia, provided guidance related to the protection of cultural resources;
- Randy Childs, an economist with Tom Witt's West Virginia economics analysis group at West Virginia University, provided input related to economic analysis; and
- Nancy Vyas, environmental engineer, looked at air, water, and soil concerns.

We worked closely with Nancy Feakes, Potomac District Ranger, Monongahela National Forest; William Tollin of the Fish and Wildlife Service who is responsible for threatened and endangered species in West Virginia; and with several scientists at the Department of Natural Resources.

Views of the public and recreational users were well expressed by members of the West Virginia Sierra Club—Bill Potter, Mary Wimmer, Rick Landenberger, and Greg Good.

The goal of the project team was to provide an independent analysis of the impacts of three alternatives for ordnance removal.

Slide 2 Background (Rocky Area)

Before logging occurred in the late 1800s, Dolly Sods was covered by a red spruce forest. Logging destroyed the ecosystem of the area: the trees were cut, the thick humus layer dried out, and sparks from the railroad caused fires that burned soil to bedrock. The area left was infertile or rocky.

As part of natural recovery, grasses began to grow in the area. Farmers continued to burn the area to maintain grazing areas.

Slide 3

In 1910 the Forest Service bought the land and it became part of the Monongahela National Forest. It was a remote area. In World War II, the army found it perfect for mountain training and artillery practice for soldiers before going overseas.

Slide 4 (gun emplacement map)

This slide shows firing locations of artillery. Soldiers shot at mountains. Ordnance was distributed throughout the area.

Slides 5 & 6 (piece of ordnance)

Ordnance fired included 57 mm armor piercing, 60 mm high explosive, 81 mm white phosphorus, and 81, 105, and 155 mm artillery shells.

After the war the area was searched and cleared, but live ordnance continues to be found. Floods cause it to be unearthed, and some was not found due to limitations in technology in the World War II search.

Slides 7 & 8 (surveyor)

The Army Corps of Engineers was charged with cleaning up areas, like Dolly Sods, that were formerly used as defense sites. The Corps hired Metcalf & Eddy, Inc., a nationally renowned environmental engineering firm, to perform a study to determine how much ordnance was present and to devise a removal plan.

In a survey of 281 acres, the survey team found 13 rounds of ordnance.

Slide 9 (Blown up ordnance area)

This is what an area of the Dolly Sods Wilderness looks like after a piece of ordnance was exploded.

Slide 10 (baseline map showing trails and campsites)

The U.S. Army Corps of Engineers, working with the Forest Service, considered several alternatives to remove ordnance ranging from no action to searching and clearing the entire 10,000+ acres. No action was not considered appropriate as the ordnance presents real danger to public safety. Search and detonation over the entire area was considered very aggressive for a wilderness area. Eventually, three alternatives were considered.

- No action (required by law);
- Search and detonation on trails and in campsites (105 acres); and
- Search and detonation on trails only (103.8 acres).

Slide 11 (surveyor)

The selected alternative is to remove ordnance from trails and campsites. Ordnance removal specialists will sweep 20′ to either side of trails and around areas used as campsites with handheld metal detectors. If metal is detected, it will be unearthed (1 foot on trails and 4 feet in campsite areas). If it is ordnance, it will be detonated in place. If it a metal object, it will be reburied in place.

The work is scheduled for spring, summer, and fall of 1996. The time required to complete the effort will be a function of what the UXO technicians find.

Slide 12 (rocky area)

This is a picture showing the intersection of Fisher Spring Run and Rohrbaugh Plains trails. This gives you an idea of the terrain that the UXO technicians will have to cover.

Slide 13 (campsites)

This is a typical campsite. The UXO technicians will not camp in the wilderness or use motorized vehicles.

Slide 14 (baseline map and shaded impact areas—generic map)

To help you get a feel for impact of the ordnance removal, this map shows areas of special concern which intersect with trails and campsite areas. These are areas which:

- are potential habitats of threatened or endangered plants or animals;
- contain remnants of logging and have cultural significance; or
- are wetlands.

The Corps has developed detailed procedures to mitigate impact so that no significant impact will result from the ordnance removal action. We will discuss impacts and mitigation plans in detail at the conclusion of the slides.

Slide 15 (signs)

Signs are currently posted at trails, and the Forest Service will post additional signs to warn users of Dolly Sods about the ordnance removal project. The Corps plans to use newspaper articles and direct mailings to known users of the Dolly Sods Wilderness to warn recreational users about plans for ordnance removal to minimize the impact on recreational users.

Slide 16 (hikers)

The Forest Service estimates that over 25,000 people visit Dolly Sods annually, mostly on weekends. Only a small portion of the visitors venture far from the roads.

Slide 17 (Red Creek Trail)

Most hikers stay on the Red Creek Trail. To minimize impact on recreation, the Corps plans not to work weekends, holidays, or in rifle deer season. Work will be planned in such a fashion as to clear most popular trails early in the season before most users arrive.

Slides 18 & 19 (table of impacts and mitigation plans)

Let's turn to the handout. It has a summary of impacts and associated mitigation plans.

APPENDIX II

A. Letters From Coordinating Agencies in Response to Public Notice

B. Letters from Coordinating Agencies in Response to Draft Environmental Assessment

DEPARTMENT OF THE ARMY
HUNTINGTON DISTRICT, CORPS OF ENGINEERS
502 EIGHTH STREET
HUNTINGTON, WEST VIRGINIA 25701-2070

REPLY TO
ATTENTION OF

April 7, 1995

Planning Division
Resource Evaluation Branch

Input Request For: Dolly Sods Wilderness, Ordnance Removal Project

In cooperation with the U.S. Forest Service the U.S. Army Corps of Engineers proposes an ordnance and explosive waste (OEW) removal action at the Dolly Sods Wilderness to reduce the risk to the public and environment from unexploded ordnance.

BACKGROUND: The 10,215-acre Dolly Sods Wilderness, located within Grant, Tucker, and Randolph Counties, West Virginia and managed by the U.S. Forest Service, was a part of the 2,181,000 acre West Virginia Maneuver Area during World War II. Even though areas were searched and cleared by military explosive ordnance disposal (EOD) teams after the war, at least 20 pieces of ordnance have been found in recent years. Some of these were found in a 1991 feasibility study by the U.S. Army Corps of Engineers. The Study included searching a sampling of areas considered to most likely have been used as targets or contain overshots or undershots. Approximately 281 acres of the 10,215 acres were searched with magnetometers and thirteen pieces of ordnance, ranging in size, were found from 6 to 24 inches beneath the surface. One piece was found within several feet of a site used as a campfire pit. If the fire had been located over the buried ordnance, there is the likelihood that the ordnance would have detonated, potentially harming several persons. There is also the potential for tent pegs to be driven into buried ordnance or for people to find and pick up pieces of ordnance, creating a hazardous situation. A high concentration of ordnance is thought to exist within the Red Creek Valley of the Wilderness, where campers are commonly found. An estimated 45,000 to 75,000 people come to the Dolly Sods Wilderness each year for hiking, camping, picnics, and hunting. The Forest Service maintains 20.8 miles of trails and has documented 101 commonly used camping areas in the Wilderness.

PROPOSED ACTION: Trails will be searched their entire length and 20 feet to each side by unexploded ordnance (UXO) specialists using hand-held ordnance detection devices such as metal detectors. If metal is indicated the area will be excavated by hand to a depth of one foot. Cleared areas used for camping will also be searched and excavated by hand to a 4-foot depth where metal is indicated. Small undergrowth, grasses, and fallen trees will be cleared only if necessary to search an area and only if the area is accessible to hikers, campers, or hunters. Earth will be excavated only if metal objects are detected. Discovered UXO will not be moved for safety reasons but will be destroyed in place by detonation.

ALTERNATIVES: Alternatives to this proposed action that are currently being considered are: (1) No Action - not searching for ordnance and only disposing of those mortars and artillery shells that are found and reported by area users and (2) clearing hiking trails and an area 20 feet on each side to a depth of one foot, but not clearing campsites.

MINIMIZING ENVIRONMENTAL IMPACTS: Before any onsite work commences, trained personnel will work closely with the U.S. Forest Service and other agencies to define potential archaeologically significant areas, sensitive plants, and animal habitats that must be protected and to establish steps to avoid or minimize impacts. Procedures for avoiding and minimizing adverse impacts will be defined in an Environmental Assessment which is currently being prepared and in a workplan to be prepared by the UXO contractor. Current plans are:

- An archaeologist will conduct a records search and site survey to define potentially significant areas and establish an action plan for protection of heritage resources for the UXO team to follow.

- A biologist will determine the potential for threatened, endangered, or sensitive species to be impacted; of particular interest are the Cheat Mountain Salamander and, possibly, the Virginia Northern Flying Squirrel. Even though it is doubtful either will be impacted by work in trails and campsites, the UXO team will be taught how to recognize them and how to avoid adverse impacts. No threatened or endangered plant species are known to exist in the Wilderness. However because regrowth is extremely slow in this harsh environment the UXO team will also be taught how to minimize impacts to plant life.

- No motorized vehicles will be used within the Wilderness.

- Disturbed areas will be covered with leaves and other materials found in the area to minimize exposure to the elements.

SOLICITATION OF INPUT: We value your opinion in this process. To assist us in our environmental evaluation, we are requesting your comments in regard to possible effects of this project no later than April 28, 1995. Your comments will be considered in planning and decisions on this proposed project. If you wish to make comments, receive further information on this project, or receive a copy of the Environmental Assessment, please reply to:

Commander
U.S. Army Corps of Engineers
ATTN: CEORH-PD-B (Mr. A. B. Borda, Jr.)
502 Eighth Street
Huntington, WV 25701-2070
Phone: 304/529-5712
Fax: 304/529-5591.

If we do not receive a reply from you we will not send further information.

James S. Everman
Chief, Planning Division

Enclosure

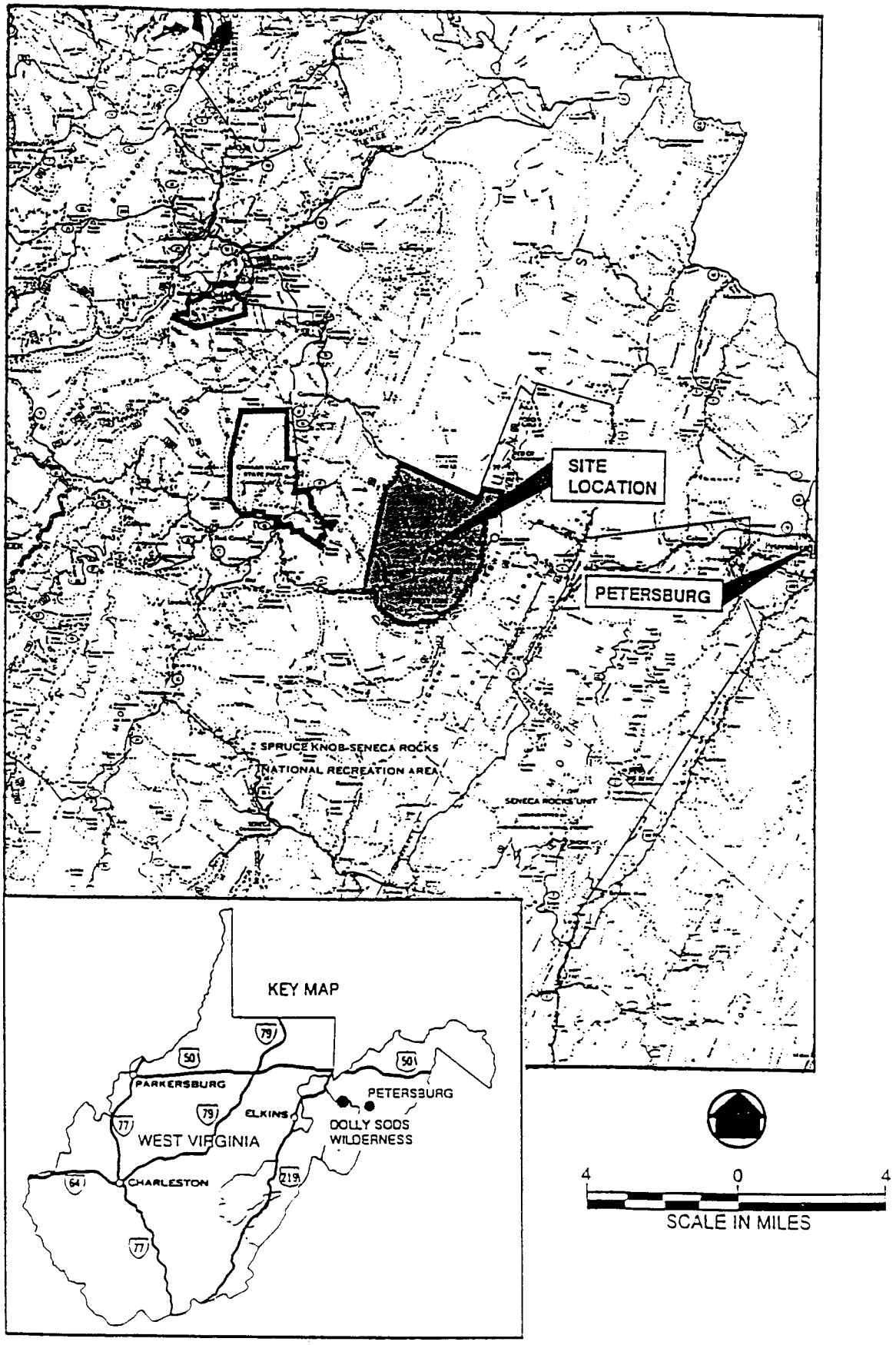

FIGURE 1-1. DOLLY SODS WILDERNESS
SITE LOCATION PLAN

United States Department of the Interior

FISH AND WILDLIFE SERVICE

West Virginia Field Office
Post Office Box 1278
Elkins, West Virginia 26241

June 2, 1995

Mr. A.B. Borda, Jr., Chief
Resource Evaluation Branch
U.S. Army Corps of Engineers
502 Eighth Street
Huntington, West Virginia 25701-2070

Dear Mr. Borda:

This constitutes a planning aid report (PAR) for the Dolly Sods Wilderness, Ordnance Removal Plan and Federally listed and candidate species located on the Monongahela National Forest in Grant, Tucker, and Randolph Counties, West Virginia. In cooperation with the U.S. Forest Service the U.S. Army Corps of Engineers, Huntington District (District) proposes to remove ordnance and explosive waste from the Dolly Sods Wilderness to reduce the risk to the public and the environment from unexploded ordnance.

This report is prepared pursuant to provisions of the Fish and Wildlife Coordination Act (48 Stat. as amended; 16 U.S.C. 661 et seq.) and the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) (ESA).

The 10,215-acre Dolly Sods Wilderness was a part of the 2,181,000 acre West Virginia Maneuver Area during World War II. Even though areas were searched and cleared by military explosive ordnance disposal teams after the war, at least 20 pieces of ordnance have been found in recent years. A high concentration of ordnance is thought to exist within the Red Creek Valley, an area heavily used by campers, hikers, hunters and other forest visitors. The U.S. Forest Service maintains 20.8 miles of trails and has documented 101 commonly used camping areas in the Wilderness.

The proposed action entails searching trails and camping areas using hand-held metal detectors. Unexploded ordnance specialists will search areas 20 feet wide on both sides of trails for their entire length and all campsites then destroying any ordnance found. If metal is indicated the trail site will be excavated by hand to a depth of one foot. Camps sites will be searched and excavated by hand to a 4-foot depth where metal is detected. Small undergrowth, grasses, and fallen trees will be cleared only if necessary to search an area and only if the areas is accessible by recreational users. Due to obvious safety reasons, any ordnance discovered will be detonated in places.

In addition to occasional transient species such as the proposed threatened bald eagle, Haliaeetus leucocephalus, two Federally listed species and seven candidates could occur in the project impact area. These include:

FEDERALLY LISTED

Northern flying squirrel, Glaucomys sabrinus fuscus
Cheat Mountain salamander, Plethodon nettingi

CATEGORY 2, CANDIDATES

Southern rock vole, Microtus chrotorrhinus carolinensis
Eastern woodrat, Neotoma floridana magister
Southern water shrew, Sorex palustris punctulatus
Appalachian cottontail, Sylvilagus obscurus
Northern goshawk, Accipter gentilis
Cerulean warbler, Dendroica cerulea
Butternut, Juglans cinerea

Although a number of listed and candidate species can occur in the project impact area, the Service is primarily concerned about possible impacts to the Cheat Mountain salamander. Several populations of the salamander and large tracts of unsurveyed high potential habitat occur in the project impact area. The Cheat Mountain salamander is nocturnal, resting during the day under leaves, logs, bark, or rocks on the forest floor. Disturbance due to clearing or ordnance detonation could directly affect the salamander.

The Service attended a meeting on May 16, 1995 with representatives of the U.S. Forest Service, District staff, and the consultant, Newbolt Enterprises. Newbolt Enterprises was furnished maps showing occupied and potentially occupied habitat of the Cheat Mountain salamander in the Wilderness. These maps were developed by Dr. Thomas Pauley of Marshall University, the authority on the species. The Service has provided additional information to Newbolt Enterprises regarding the ESA aspects of the project.

In accordance with Section 7(a)(2) of the ESA, Federal agencies are required to ensure that any actions they carry out, fund, or authorize are not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of the critical habitat of such species. If the Federal agency determines that its proposed action may affect a listed species or critical habitat, it must consult with the Service. In the case of a proposed species, it must confer with the Service.

Pursuant to Section 7 (c) of the ESA, the Service recommends that a biological assessment be prepared regarding the impacts of the project on listed and proposed species. The purpose of the biological assessment is to determine whether or not any such species and habitat are likely to be adversely affected by the action. Biological assessments are designed to assist Federal agencies determine if formal consultation or a conference is required. The following information should be included in the preparation of the biological assessment to evaluate the impacts to the endangered northern flying squirrel and the threatened Cheat Mountain salamander.

1. Conduct interviews of recognized experts on the species at issue, including those within the Service, WVDNR, universities and others who may have data not yet found in scientific literature.

2. Review up to date literature and other scientific data to determine the species distribution, habitat needs, and other biological requirements.

3. Analyze the effects of the action on individuals and populations of each species and its habitat, including indirect and cumulative effects of the action.

5. Analyze alternative actions that may provide reasonable and prudent or conservation measures.

6. Conduct any studies necessary to fulfill the requirements of (1) through (5) above.

7. Review any other relevant information.

If you determine that the proposed action "may affect" any of the listed species or Critical Habitats you must request, in writing, formal consultation with our office, pursuant to Section 7(a) of the ESA. If the determination is "no effect," no further consultation is necessary, unless requested by the Service. Regardless of your findings you should provide this office a copy of the biological assessment and any other relevant information that assisted you in reaching your conclusion. If you have any questions, please contact William A. Tolin at this office (304-636-6586).

Sincerely,

Christopher M. Clower

Christopher M. Clower
Supervisor

United States Department of Agriculture | Forest Service | Monongahela National Forest | 200 Sycamore Street
Elkins, WV 26241-3962
VOICE and TTY 304-636-1800
FAX 304-636-1875

"The Forest Service is a multicultural organization and is committed to the goal of ensuring equal opportunity for all in employment and program delivery."

File Code: 2320

Date: June 07, 1995

Nancy Vyas, Environmental Engineer
New-Bold Enterprises
1489 Locust Avenue, Suite E
Fairmont, WV 26554

Dear Nancy:

I am writing in response to the questions you asked about the Dolly Sods Wilderness Ordnance Removal Project in your June 1 letter.

We did not conduct a formal analysis of the impacts from the work performed in the 1991 Feasibility Study. There were minor impacts and disturbances to the vegetation and soils observed in 1991, and we are in the process of photographing some of those disturbance areas this week. Monica Gallion and Jill Shoemaker, two of our forestry technicians who have worked in the Dolly Sods area, observed several mortars being exploded in the 1991 study and since. They reported that, for the most part, the ordnance was moved to rocky areas with little vegetation before it was exploded and that the environmental damage occurring was "negligible" - in some cases hardly noticeable. In at least one instance when the partially exposed ordnance was detonated in place, (with explosives and cover being placed on top of it), the resulting 1 - 1 1/2 foot-deep hole was filled with rocks and soil, and plant litter was placed on top of it so that it was less noticeable.

In many of the areas where the digging of metal will take place, the soil profile was disturbed and/or overturned by explosions of ordnance during the training exercises fifty years ago. Additional disturbance by digging to identify and recover the metal objects located during this operation will not be significant, if steps are taken to prevent erosion and protect aesthetic values. This project will disturb well under 1 percent of the acreage in the Wilderness.

We did not observe or hear any reports of changes in water quality as a result of the 1991 study, and our monitoring did not show a change in air quality. No fires occurred as a result of that work. Wetlands were not included in the 1991 study.

One known historic archeological site was impacted by the digging in the 1991 feasibiliity study. Treatment of the artifacts found in this process did not provide the level of protection that we would like to see in this upcoming phase of remediation. To assure better protection, we suggest the following steps be taken:

1. The Forest Service will perform or oversee a visual survey of the impact area to locate sites, do an initial assessment, map locations, and write a report with recommendations. (This will not likely include prehistoric sites.)

2. When the ordnance removal work begins, if a recommendation cannot be followed, COE or their contractors will notify the FS archaeologist to work out a compromise. This may involve her or another archeologist being present for digging and to record information.

3. If prehistoric artifacts are found by the ordnance removal workers, they will immediately notify the FS archaeologist and provide for an archeologist to assess the site.

Noise was an impact to some Wilderness users during the 1991 feasibility study, but it was not something that disturbed people to the point that they complained about it. The disturbances were brief, limited to air horn blasts and the sounds of the detonations themselves. These occurred mid-week and only on a few days. Adequate notices were posted so that most visitors knew that they may be occurring and understood why. Most of the individuals we talked to said that they believed that the extra safety resulting from having the bombs exploded was worth the noise.

Prior to the 1991 study, we did not realize the extent of the disturbance that would occur due to digging, and did not require a survey for Cheat Mountain Salamander. Though small areas of their habitat were disturbed during the digging operations, there were no large or continuous areas of disturbance that would significantly restrict the salamander movements. Because most of the ordnance was moved to the dry, rocky sites before being exploded, few of the explosions would have impacted the salamanders.

During the proposed ordnance removal project, the Forest Service intends to have an employee available on-the-ground to serve as a liaison and to provide assistance to the contractors in assuring protection of the resources. This person will not be able to be with all the workers at all times, but will be able to coordinate with all of the work groups on a regular basis, (probably daily). This person will not be an expert in all the various resource fields, but will probably be either a forestry technician or a forester with background in land management including Wilderness management.

We do not anticipate requiring additional specialists (archeologists, biologists, etc.) to be present in the field throughout the project, unless

there is a need for them indicated by the EA. There may be a need for them to be present at various times based upon the resources that are discovered. Since our specialists will be engaged in other work and not available to respond immediately when needed, we have recommended that the COE obtain the services of other archeologists and biologists to be on call for their team.

If you have any further questions, please contact District Ranger Nancy Feakes.

Sincerely,

JIM PAGE
Forest Supervisor

On June 7, 1995 I hiked along the Red Creek corridor in an attempt to observe the natural revegetation of sites where UXO has been found and dug out of the ground in the 1991 feasibility study conducted by a contractor for the US Army Corp of Engineers. I was also looking for sites where one or more of the ordnance had been detonated. I did a visual survey of the area identified as "Area 7" in the Feasibility study report prepared by Metcalf & Eddy, Inc. in 1992. The report stated that UXO was found in this area which is the floodplain of Red Creek bordered on both sides by steep slopes. I saw no obvious signs of UXO removal from the ground or detonation of UXO. The understory is grass and rhododendron and the ground is somewhat rocky. The forest is rather open in this area. Portions of a turn of the century railroad grade are visible where flood waters have not destroyed it.

I located a site along the Red Creek corridor where one mortar round was located by visitors in August, 1994 and then detonated by US Army personnel in September, 1994. I was present at the detonation. The ordnance was partially buried therefore the Army personnel decided not to move it to another location to detonate and also decided to blow it into the ground rather than upward. This area was located in the floodplain where only very high water channels dissect the plain. The ground was covered with a thin layer of soil with rocks protruding throughout. The ordnance was buried in rock and soil.

After the explosion a sulphur scented smoke hung in the air for several minutes. The loud sound of the explosion only lasted a second or two. I did not observe any impact to the water quality of Red Creek which was approximately 100 feet away. My only observation of wildlife at the time was a pause in the bird songs which resumed several minutes after the detonation. A hole approximately 18" deep by 5ft long by 4ft wide was left by the detonation. We filled this with the rock fragments (approx the size of two softballs) that had been broken by the explosion. Some tree roots (approx <1" in diameter) were exposed and they extended out over the crater.

I observed this same site on June 7, 1995 and found the hole to be filled with leaf litter so that the depth was no greater than one foot at any point. The crater was still 5ft long by 4ft wide. The exposed roots were no longer functional but the two birch trees (approx. 4" in diameter) had green leaves and appeared to be healthy. I saw no signs of erosion immediately surrounding the crater. Because of the rocky and uneven ground in this area the hole left by the detonation that occurred nine months ago is relatively unnoticeable by the average visitor. The turn-of-the-century logging and frequent flooding of Red Creek have left depressions and gullies throughout the Red Creek corridor. I am defining the Red Creek corridor as the land that lays between the steep-sided walls of the mountains on both sides of the creek.

I have also observed ordnance detonation on the grassy plains of the Dolly Sods Scenic Area located north and east of the Dolly Sods Wilderness. The holes left by these explosions were not as deep or long as the one previously discussed. The ordnance was placed on rocks which were fragmented by the explosion. I do not feel that the UXO detonations I have witnessed have had significant impacts on the resources of the Wilderness or Scenic Area.

Jill Shoemaker
Forestry Technician
6/7/95

DNR
West Virginia
Division of
Natural Resources

CHARLES B. FELTON, JR.
Director

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June 29, 1995

Ms. Nancy Vyas
New-Bold Enterprises
7628 Laurel Leaf Drive
Potomac, MD 20854

Dear Nancy:

I have reviewed the preliminary draft of the Environmental Assessment (EA) for the Corps of Engineers ordnance removal project in the Dolly Sods Wilderness Area. As a whole the EA looks fine. I do have comments concerning various tables and the number of rare plant species in West Virginia.

Table 5-1 *Aconitum reclinatum* (white monkshood) is listed as possibly occurring in the Wilderness Area, when actually it is present in the Wilderness Area.

Table 5-2 Several species are listed as having possible likelihood of occurrences in the Wilderness Areas. The following species are present in the Wilderness Area: *Aconitum reclinatum* (white monkshood), *Amelanchier bartramiana* (oblong-fruited serviceberry), *Glyceria grandis* (a manna-grass), *Carex paucilfora* (few-flowered sedge), *Dalibarda repens* (star violet), *Scirpus atrocinctus* (black girdle bulrush) and *Zigadenus leimanthoides* (oceanorus).

Lechea leggettii and *Lemna valdiviana* should have "doubtful" as the likelihood of occurrence.

Tables III-A and III-B should be corrected with the above information.

Table 5-3 *Glaucomys sabrinus fuscus* (northern flying squirrel): likelihood of occurrence should read "Present: known population and suitable habitat in project area."

Plethodon nettingi (Cheat Mountain salamander): likelihood of occurrence should read "present."

Neotoma magister (Allegheny woodrat): likelihood of occurrence should read "probable."

Tables IV-A and IV-B should be corrected with the above information.

Page 6-11 Third paragraph: There are not 399 rare plants on the Natural Heritage Program tracking list. Our current (and recently revised) list has 378 species. The previous list had 372. I have enclosed rough draft of the tracking list (it is a final list, but in rough form), as well as information on name changes and species dropped from the list. Your information (including tables) should be updated accordingly.

Table III-A *Polemonium van-bruntiae* (Jacob's-ladder): likelihood of occurrence should read "possible."

Table III-B *Prunus alleghaniensis* (Allegheny plum): likelihood of occurrence should read "possible."

Thank you for the opportunity to comment. P.J. Harmon is unavailable, and will be unable to comment before your deadline. I will pass the EA along to him.

If you should have any questions please feel free to call me.

Sincerely,

Barbara

Barbara Sargent
Environmental Resources Specialist
Natural Heritage Program
Wildlife Resources Section

cc: Walt Lesser
P.J. Harmon

enclosures

WEST VIRGINIA DIVISION OF
CULTURE AND HISTORY

July 11, 1995

Ms. Nancy Vyas
New-Bold Enterprises
1489 Locust Ave, Ste. E
Fairmont, WV 26554

RE: Dolly Sods Wilderness Area Ordnance Removal Project
FR: 95-929-MULTI

Dear Ms. Vyas,

We have reviewed your letter dated June 9, 1995 requesting information about known cultural resources located within the Dolly Sods Wilderness Area which might be impacted by the planned ordnance removal program. As required by Section 106 of the National Historic Preservation Act, we submit our comments on the above referenced project.

Further review of maps and documents on file at our office indicate that there are a number of previously recorded archaeological or historic sites located within the Dolly Sods Wilderness Area. Many of these sites are located near known trails, roads, campgrounds and picnic areas and conceivably could be impacted by the ordinance removal project.

More specific information concerning the level of investigations that have been conducted within USDA-USFS property and locations of cultural resources must be obtained from Forest Service Archaeologist Ruth Brinker. Ms. Brinker can be reached at the following number - 304/636-1800.

We appreciate the opportunity to be of service. If you have any questions, please contact Patrick Trader, Senior Archaeologist.

Sincerely,

Susan M. Pierce

Susan M. Pierce, Deputy State
Historic Preservation Officer
for Resource Protection

SMP:PDT

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August 21, 1995

Mr. A. B. Borda, Jr.
U.S. Army Corps of Engineers
Huntington District
502 Eighth Street
Huntington, WV 25701-2070

Dear Mr. Borda:

The West Virginia Division of Natural Resources (WVDNR) has reviewed the draft environmental assessment, Ordnance Removal at the Dolly Sods Wilderness. The WVDNR offers the following comments and suggestions.

1. Page 5-19, Table 5-4 -- The public use study was conducted in September. Hunting, pre-season scouting, etc. were not recognized as important activities because they do not usually begin in earnest until October. A six-month ordnance removal project could result in excessive displacement or disturbance of hunters (as well as other users), particularly if the activity is conducted during deer bow and gun seasons or bear gun season.

2. Page 1-8, Table 1-2, Public Safety -- The statement "... most users stay on trails and in campsite areas ..." may be true for hikers and backpackers, but this is not true for hunters. Hunters generally use roads and trails for access, but rarely hunt along trails.

3. Page 1-1 -- Purpose of Project: Referring to the statement, "Unexploded munitions present an imminent and present danger to the public welfare," it seems that hikers and backpackers are the primary consideration since only trails and campsites are being searched. Most of the area to be searched falls outside the practice range areas. Some areas bordering the wilderness (e.g., NW of Forest Road 80 and new land purchases north of the wilderness) will not be searched.

A Forest Service special use application is pending for at least one target area near the Timberline ski area. To ensure public safety, an ordnance search should be completed on these lands as part of the special use permit evaluation.

The Forest Service should consider searching the recently purchased lands north of the wilderness area as part of this project because it will likely require searching in the near future. This will reduce the total amount of time the entire area is disturbed.

4. Page 4-5 -- Every effort should be made to complete the search as quickly as possible. Trail and area closures could severely impact hunting recreation if the project is conducted between October 1and December 31.

5. Page 6-21 -- It is stated here that areas up to 4000 feet from a detonation site may be closed. While not clearly stated, it is assumed that this closure will be in effect from the time of discovery of the unexploded ordnance until completion of the detonation process. Should the unexploded ordnance be discovered in Cheat Mountain salamander habitat and a rain event does not occur for several days, large areas could be closed for an indeterminant length of time. The WVDNR concurs with measures proposed to protect the salamander, but contends that closure of a 4000 foot radius from the unexploded ordnance is excessive. In cases where closure is required until conditions are suitable to survey for salamanders, a reduced closure area should be considered.

Sincerely,

James W. Rawson

James W. Rawson
Supervisor, Coordination
Wildlife Resources Section

JWR/kw

Wayne W.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

West Virginia Field Office
Post Office Box 1278
Elkins, West Virginia 26241

August 22, 1995

Colonel Richard W. Jemiola
District Engineer
U.S. Army Corps of Engineers
502 Eighth Street
Huntington, West Virginia 25701

Dear Colonel Jemiola:

This is in response to your July 21, 1995 request for review of the Dolly Sods Wilderness Ordnance Removal Project Draft Environmental Assessment (EA) dated July 7, 1995 regarding consultation pursuant to Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq) (ESA). The U.S. Army Corps of Engineers, Huntington District (District) proposes to remove unexploded ordnance from the Dolly Sods Wilderness on the Monongahela National Forest in West Virginia. The purpose of the project is to reduce the risk to the public and to the environment from unexploded ordnance.

The District has agreed to implement the measures described in the EA and the Biological Evaluation in Appendix IV, Part C, to avoid the likelihood of adverse impacts from the proposed action on the endangered Virginia northern flying squirrel, Glaucomys sabrinus fuscus and the threatened Cheat Mountain salamander, Plethodon nettingi.

Background

Informal consultation between the U.S. Fish and Wildlife Service and the District relative to the project began by letter dated June 2, 1995, when the Service informed the District of the presence of the endangered G. s. fuscus and the threatened P. nettingi in the Dolly Sods Wilderness. The Service requested that the District prepare a biological assessment (BA) in accordance with Section 7(a)(2) of the ESA. The July 7, 1995 EA provides the requested information.

Proposed Project

The 10,215-acre Dolly Sods Wilderness was a part of the 2,181,000 acre West Virginia Maneuver Area during World War II. Even though areas were searched and cleared by military explosive ordnance disposal teams after the war, at least 20 pieces of ordnance have been found in recent years. A high concentration of ordnance is thought to exist within the Red Creek Valley, an area heavily used by campers, hikers, and hunters. The U.S. Forest Service maintains 20.8 miles of trails and has documented 101 commonly used camping areas in the Wilderness.

The proposed action entails searching 20 feet along each side of the entire length of all trails using hand-held metal detectors. If metal is indicated the area will be excavated by hand to a depth of one foot. Camps sites will be searched and excavated by hand to a 4-foot depth where metal is detected. Small undergrowth, grasses, and fallen trees will be cleared only if necessary to search an area and only if the areas is accessible by recreational users. Due to obvious safety reasons, any ordnance discovered will be detonated in place.

Review of Endangered Species Information

Virginia northern flying squirrel, Glaucomys sabrinus fuscus

The northern flying squirrel, Glaucomys sabrinus is a boreal forest species which occurs from Alaska and Canada to New England and south to North Carolina and Tennessee. The subspecies G. s. fuscus occurs only in West Virginia and slightly into the Allegheny Mountains of Virginia. In West Virginia the squirrel prefers high elevation mixed northern hardwood, red spruce, and hemlock forest in Pendleton, Pocahontas, Tucker, Webster, Greenbrier, and Randolph Counties. Its diet primarily consists of fungi, lichens, and staminate cones. Nuts, fruits, and seeds make up a lesser part of its diet. G. s. fuscus is active year-round and does not hibernate or undergo torpidity. It is primarily nocturnal, being more active in the evening hours, but may emerge for short periods during the day. It can have up to two litters of young each year, with young being born in late March and again in late August. Young often stay with their mothers during the winter months and are included in the wintering aggregation which is common to flying squirrels.

Cheat Mountain salamander, Plethodon nettingi

P. nettingi prefers mixed northern hardwood and red spruce forest of the higher elevations of Grant, Tucker, Randolph, Pocahontas, and Pendleton Counties. It is nocturnal but during day can be found in the interior of decayed logs or under rocks and fallen limbs. Its diet consists primarily of mites, springtail, beetles, flies, and ants. Eggs have been observed from May to August, usually with the female in attendance. The total range extends from Blackwater River canyon in the northeast to Dolly Sods, southeast to Spruce Knob, and west through McGowan and Cheat Mountains southwest to Thorny Flat.

Reasons for Decline and Continued Threats

The major threats to G. s. fuscus are the destruction of the red spruce and mature northern hardwood habitat and the expansion of the more aggressive southern flying squirrel, Glaucomys volans.

Habitat modifications that remove the forest canopy are probably the primary factors affecting the habitat of P. nettingi. Removal of the forest canopy permits a greater percentage of sunlight to reach the forest floor, resulting in an increase in soil temperature and a decrease in soil moisture. Activities that remove the forest canopy include road development, ski slopes, various methods of timber harvesting, wildlife openings, utility rights-of-way, mining activities, insect infestations such as gypsy moths, and some wildfires. P. nettingi is also threatened by two more aggressive salamander species the redback salamander, Plethodon cinereus and the mountain dusky salamander, Desmognathus ochrophaeus. Acid rain may also pose a threat to P. nettingi by decreasing soil pH.

Status of the species

There is one known population of G. s. fuscus in the project area. This population is near the northwest corner of the Dolly Sods Wilderness. Other sites within the project area contain high potential habitat for the species.

There are two known populations of P. nettingi in the Dolly Sods Wilderness. Both of these populations are bisected by hiking trails, Fisher Spring Trail and Rohrbaugh Plains Trail. Most of the project area is considered high potential habitat for the species.

Effects of the action

If ordnance must be removed or detonated, digging holes and detonation of the ordnance could directly affect both species. However, the Service concurs with the District that, with implementation of the following measures, as described in the Environmental Assessment and the Biological Evaluation, the proposed project is not likely to adversely affect the subject two species.

Glaucomys sabrinus fuscus

In all potential habitat where ordnance must be detonated, crews should use noise-deadening techniques, such as sand bags. This should reduce the disturbance and reduce the possibility of shrapnel damaging trees.

Plethodon nettingi

When ordnance is suspected, crews will be responsible for all excavations. They will carefully remove all litter, soil, and vertebrates. Litter and soil will be placed in separate containers and each vertebrate species will be put in a clean separate jar. After excavation is completed and no ordnance discovered, soil, litter, and vertebrates will be returned to the precise location from where they were removed. A biologist will instruct the crews regarding proper removal and return of vertebrate species. If ordnance is discovered, a biologist will assess the surrounding area for potential P. nettingi habitat and surveys for the species will be conducted. Surveys will be conducted at night and within 48 hours of a rainfall. The area to be surveyed will include the estimated size of the crater plus 40 feet in all directions. If P. nettingi is located, each specimen will be place in a separate jar, maintained in a cool environment (approximately 15 degrees centigrade), and returned to the precise locations after the area has been restored (no longer than 24 hours).

In restoring the site, the litter and soil from the site will be returned to the crater. Logs and flat stones from the immediate area will be placed over the soil. Additional soil and litter required to fill the crater, will be obtained within 100 feet of the site. No soil or litter should be transported from outside of the immediate area. To minimize the effects of the transfer of soil and litter, small quantities will be removed from several areas within the designated area. Foreign litter and soil could contain juveniles of the competitor salamanders P. cinereus and D. ochrophaeus. Soil and litter will be carefully examined for all salamander species. No species of salamander will be removed from its territory. Foot travel and cutting of vegetation will be held to a minimum in all potential habitat areas.

Conclusion

Based upon the District's proposed implementation of the above-listed measures, the Service concurs with the District's finding that the proposed ordnance and waste removal action at the Dolly Sods Wilderness is not likely to adversely effect G. s. fuscus and P. nettingi.

This concludes the need for further action on this project as required under Section 7 of the ESA. Should this project be modified or new information becomes available or "take" occurs consultation should be reinitiated. Such action may include implementation of additional measures to minimize harm to the species.

If you have any questions, please contact me at this office (phone 304-636-6586).

Sincerely,

William A Tolin

William A. Tolin
Acting Supervisor

WEST VIRGINIA DIVISION OF
CULTURE AND HISTORY

August 30, 1995

Mr. James Everman
Dept. of the Army
502 Eighth Street
Huntington, WV 25701

RE: Dolly Sods Wilderness Ordnance
Removal Project - Environmental Assessment
FR: 95-929-MULTI

Dear Mr. Everman,

We have received and reviewed the following document: "Dolly Sods Wilderness Ordnance Removal Project Environmental Assessment - Draft". As required by Section 106 of the National Historic Preservation Act, we offer our comments on the above referenced project.

Upon review of the Environmental Assessment (EA), it is our understanding that the US Army Corps of Engineers plans to conduct a magnotometer survey of the Dolly Sods Wilderness Area to identify the locations of unexploded ordnance.

It is our understanding that Alternative 1 is the preferred alternative. For this alternative, a surface and subsurface inspection will be made of 20.8 miles of roads and hiking trails and 100 campsites. A total of 105 acres will be investigated by crews trained in detecting unexploded ordnance. During the course of their investigation, all positively located metals will be marked and excavated.

According to the EA an archaeological investigation consisting of a surface inspection of the hiking trails, roads and campsites will be conducted prior to COE investigations. In addition, ordnance crews will record and photograph all artifacts encountered during the magnotometer survey. If prehistoric archaeological sites are encountered, a USFS archaeologist will be contacted for technical advice.

Based on this information, it is our opinion that the USCOE is making a good faith effort in which to identify cultural resources within the project area and will contribute significant knowledge to our database concerning archaeological sites within the Dolly Sods Wilderness Area.

THE CULTURAL CENTER • 1900 KANAWHA BOULEVARD, EAST • CHARLESTON, WEST VIRGINIA 25305-0300
TELEPHONE 304-558-0220 • FAX 304-558-2779 • TDD 304-558-0220

We appreciate the opportunity to comment on the EA. If you have any questions, please contact Patrick Trader, Senior Archaeologist.

Sincerely,

Susan M. Pierce

Susan M. Pierce
Deputy State Historic Preservation
Officer for Resource Protection

SMP:PDT

APPENDIX III

Botanical Species of Concern

A. Endangered, Threatened and Sensitive Botanical Species in the Monongahela National Forest and Likelihood of Occurrence in the Dolly Sods Wilderness.

B. Rare Botanical Species in West Virginia and Likelihood of Occurrence in the Dolly Sods Wilderness.

Explanation of Status

E = Federal listing as Endangered
T = Federal listing as Threatened

C2 = Candidate for Federal listing; information on hand indicates that proposing to list is possibly appropriate, but conclusive data are not currently available to support it.

G = Natural Heritage Program Global Rank

G1 = Less than 6 occurrences globally; critically imperiled; especially vulnerable to extinction.

G2 = 6-20 occurrences globally; imperiled and very vulnerable to extinction throughout its range.

G3 = 21-100 occurrences globally; either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g. in a single state or physiographic region) or because other factors make it vulnerable to extinction throughout its range.

G4 = Apparently secure globally.

G5 = Demonstrably secure globally.

S = Natural Heritage Program State Rank

S1 = Critically imperiled in state. Five or fewer occurrences.

S2 = Imperiled in state. 6-20 occurrences.

S3 = Rare or uncommon in state. 21-50 occurrences.

SH = Historical occurrence in state.

\- = Status not determined.

T_ = Status of subspecies or variety.

Q = Status questionable.

Explanation of Status
(Continued

West Virginia Division of Natural Resources Ranking

Special Concern = A species which was once more common or widespread in West Virginia and is now thought to be declining, becoming more restricted in range or possibly extirpated.

Scientific Interest = A species which has a unique scientific value or has probably always been uncommon in West Virginia because the state is on the periphery of its range.

Undetermined Species = Species believed to be uncommon in West Virginia, but supportive data are lacking.

USDA — Forest Service Eastern Region Sensitive Species List

1 = Restricted to the Forest within the state.

2 = Found within the Forest and other areas within the state.

3 = Documented extant occurrence within the Forest.

4 = Breeding population.

EX = Previously present but now extirpated from the Forest.

Table III-A
Endangered, Threatened and Sensitive Botanical Species in the Monongahela National Forest and Likelihood of Occurrence in the Dolly Sods Wilderness

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Shale Barren Rock Cress	*Arabis serotina*	*Arabis serotina*	None	Very Unlikely	E
Virginia Spirea	*Spiraea virginiana*	*Spiraea virginiana*	None	Very Unlikely	
Running Buffalo Clover	*Trifolium stoloniferum*	*Trifolium stoloniferum*	Considerable—positive	Possible	E
Fraser Fir	**Not on this list**	*Abies fraseri*	None	Very Unlikely	
White Monkshood	*Aconitum reclinatum*	*Aconitum reclinatum*	Considerable	Present	
Lillydale Onion	*Allium oxyphilum*	*Allium oxyphilum*	None	Very Unlikely	
Bradley's Spleenwort	*Asplenium bradleyi*	*Asplenium bradleyi*	Minor	Doubtful	
Smooth Blue Aster	*Aster laevis* var. *concinnus*	*Aster laevis* var. *concinnus*	None	Very Unlikely	
Cooper's Milkvetch	**Not on this list**	*Astragalus neglectus*	None	Very Unlikely	C2
American Barberry	*Berberis canadensis*	*Berberis canadensis*	None	Very Unlikely	
Lanceleaf Grape Fern	*Botrychium lanceolatum* var. *angustisegmentum*	*Botrichium lanceolatum* var. *angustisegmentum*	Minor	Doubtful	
Bluntlobe Grape Fern	*Botrychium oneidense*	*Botrychium oneidense*	Minor	Doubtful	
Harned's Swamp Clintonia	*Clintonia alleghaniensis*	*Clintonia alleghaniensis*	Minor	Possible	
Tall Larkspur	*Delphinium exaltatum*	*Delphinium exaltatum*	None	Very Unlikely	C2
Shale Barren Wild Buckwheat	*Eriogonum alleni*	*Eriogonum alleni*	None	Very Unlikely	

* See key on page 9-III-2

Table III-A (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Darlington's Spurge	*Euphorbia purpurea*	*Euphorbia purpurea*	Major	Probable	C2
Box Huckleberry	*Gaylussacia brachycera*	*Gaylussacia brachycera*	None	Very Unlikely	
White Alumroot	*Heuchera alba*	*Heuchera alba*	Considerable	Probable	
Long-Stalked Holly	*Ilex collina*	*Ilex collina*	Minor	Possible	
Buttemut	*Juglans cinerea*	*Juglans cinerea*	Minor	Doubtful	C2
Turgid Gay Feather	*Liatris turgida*	*Liatris turgida*	None	Very Unlikely	
American Gromwell	*Lithospermum latifolium*	*Lithospermum latifolium*	None	Very Unlikely	
Sundial Lupine	*Lupinus perennis*	*Lupinus perennis perennis*	Minor	Doubtful	
Large-Flowered Barbara's Buttons	*Marshallia grandiflora*	*Marshallia grandiflora*	None	Very Unlikely	C2
Smokehole Bergamot	*Monarda fistulosa* var. *brevis*	*Monarda fistulosa* ssp. *brevis*	None	Very Unlikely	C2
Shale Barren Evening Primrose	*Oenothera argillicola*	*Oenothera argillicola*	None	Very Unlikely	
Canby's Mountain Lover	*Pachistima canbyi*	*Paxistima canbyi*	None	Very Unlikely	C2
Virginia (or Yellow) Nailwort	*Paronychia virginica* var. *virginica*	*Paronychia virginica*	None	Very Unlikely	C2
Swordleaf Phlox	*Phlox buckleyi*	*Phlox buckleyi*	None	Very Unlikely	
Jacob's Ladder	*Polemonium van-bruntiae*	*Polemonium van-bruntiae*	Considerable	Possible	
Tennessee Pondweed	*Potamogeton tennesseensis*	*Potamogeton tennesseensis*	Minor	Doubtful	

* See key on page 9-III-2

Table III-A (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Nodding Rattlesnake Root	*Prenanthes crepidinea*	*Prenanthes crepidinea*	None	Very Unlikely	
Cliff Stonecrop	*Sedum glaucophyllum*	*Sedum glaucophyllum*	None	Very Unlikely	
Rock Skullcap	*Scutellaria saxatilis*	*Scutellaria saxatilis*	Minor	Possible	
Robust Fire Pink	*Silene virginica* var. *robusta*	*Silene virginica* var. *robusta*	Minor	Doubtful	C2
Shale Barren Goldenrod	*Solidago arguta* var. *harrissii*	*Solidago arguta* var. *harrissii*	None	Very Unlikely	
Virginia Mountain Pimpernel	*Taenidia montana*	*Pseudotaenidia*	None	Very Unlikely	
Ammon's Tortula	*Tortula ammonsiana*	*Tortula ammonsiana*	Major	Possible	
Kate's Mountain Clover	*Trifolium virginicum*	*Trifolium virginicum*	None	Very Unlikely	
Appalachian Blue Violet	*Viola appalachiensis*	*Viola appalachiensis*	Considerable	Possible	
Sand Grape	*Vitis rupestris*	*Vitis rupestris*	None	Very Unlikely	
Appalachian Shoestring Fern	*Vittaria appalachiana*	*Vittaria appalachiana*	Minor	Possible	

See key on page 9-III-2

Table III-B
Rare Botanical Species in West Virginia and Likelihood of Occurrence in the Dolly Sods Wilderness

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	
Balsam Fir	*Abies balsamea*	*Abies balsamea*	Major	Very Likely	
White Monkshood	*Aconitum reclinatum*	*Aconitum reclinatum*	Considerable	Present	
False Aloe	*Agave virginica*	*Manfreda virginica*	None	Very Unlikely	
Small-Fruited Agrimony	*Agrimonia microcarpa*	*Agrimonia microcarpa*	Minor	Doubtful	
Slender Wheatgrass	*Agropyron trachycaulum*	*Elymus trachycaulus* var. *trachycaulus*	Considerable	Possible	
A Bentgrass	*Agrostis borealis*	*Agrostis mertensii*	Considerable	Possible	
Northern Water Plantain	*Alisma triviale*	*Alisma triviale*	Considerable	Possible	
Nodding Onion	*Allium oxyphilum*	*Allium oxyphilum*	None	Very Unlikely	
Oblong-Fruited Serviceberry	*Amelanchier bartramiana*	*Amelanchier bartramiana*	Minor	Present	
Scarlet Ammannia	*Ammannia coccinea*	*Ammannia coccinea*	None	Very Unlikely	
False Indigo	*Amorpha fruticosa*	*Amorpha fruticosa*	None	Very Unlikely	
Peppervine	*Ampelopsis arborea*	*Ampelopsis arborea*	None	Very Unlikely	
Peppervine	*Ampelopsis cordata*	*Ampelopsis cordata*	None	Very Unlikely	
Bog Rosemary	*Andromeda polifolia* var. *glaucophylla*	*Andromeda polifolia* var. *glaucophylla*	Major	Doubtful	
Canada Anemone	*Anemone canadensis*	*Anemone canadensis*	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
A Rockcress	*Arabis perstellata*	*Arabis shortii*	None	Very Unlikely	
Hairy Rockcress	*Arabis pycnocarpa*	*Arabis hirsuta* var. *pycnocarpa*	None	Very Unlikely	
Shale Barren Rockcress	*Arabis serotina*	*Arabis serotina*	None	Very Unlikely	E
Short's Rockcress	*Arabis shortii*	*Arabis shortii*	None	Very Unlikely	
Mountain Sandwort	**Not on this list**	*Minuartia groenlandica*	Considerable	Doubtful	
Purple Three-Awn Grass	*Aristida purpurascens*	*Aristida purpurascens*	None	Very Unlikely	
Giant Cane	*Arundinaria gigantea*	*Arundinaria gigantea*	None	Very Unlikely	
Virginia Heartleaf	*Asarum memmingeri*	*Hexastylis memmingeri* **Removed from tracking list**	None	Very Unlikely	
Large-Flowered Heartleaf	*Asarum shuttleworthii*	*Hexastylis shuttleworthii* **Removed from tracking list**	None	Very Unlikely	
Green Milkweed	*Asclepias viridis*	*Asclepias viridis*	None	Very Unlikely	
Forked Spleenwort	*Asplenium septentrionale*	*Asplenium septentrionale*	None	Very Unlikely	
Rushlike Aster	*Aster juncíformis*	*Aster borealis*	None	Very Unlikely	
Long-Leaved Aster	*Aster novi-belgii*	*Aster novi-belgii* var. *elodes*	Considerable	Doubtful	
Narrowleaf Aster	*Aster solidagineus*	*Aster solidagineus*	None	Very Unlikely	
Steeles Aster	*Aster steeleorum*	*Aster laevis* var. *laevis* **Removed from tracking list**	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Northeastern Aster	*Aster tardiflorus*	*Aster novi-belgii* var. *tardiflorus*	None	Very Unlikely	
False Goat's Beard	*Astilbe biternata*	**Removed from tracking list**	None	Very Unlikely	
Bent Milkvetch	*Astragalus distortus*	*Astragalus distortus*	None	Very Unlikely	
Cooper's Milkvetch	**Not on this list**	*Astragalus neglectus*	None	Very Unlikely	C2
Paper Birch	*Betula papyrifera*	*Betula papyrifera*	Minor	Probable	
Triangle Grape Fern	*Botrychium lanceolatum*	*Botrychium lanceolatum* var. *angustisegmentum*	None	Very Unlikely	
Chamomile Grape Fern	*Botrychium matricariifolium*	*Botrychium matricariifolium*	None	Very Unlikely	
Side-Oats Grama	*Bouteloua curtipendula*	*Bouteloua curtipendula*	None	Very Unlikely	
A Reedgrass	*Calamagrostis neglecta*	*Calamagrostis stricta* ssp. *stricta*	Considerable	Possible	
A Reedgrass	*Calamagrostis porteri*	*Calamagrostis porteri* ssp. *porteri*	None	Very Unlikely	
Grass Pink Orchid	*Calopogon tuberosus*	*Calopogon tuberosus* var. *tuberosus*	Major	Probable	
Carolina Allspice	*Calycanthus floridus*	*Calycanthus floridus*	None	Very Unlikely	
Shale Barren Bindweed	*Calystegia spithamaea* ssp. *purshiana*	*Calystegia spithamaea* ssp. *purshiana*	None	Very Unlikely	
Bluebell	*Campanula rotundifolia*	*Campanula rotundifolia*	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Bitter Cress	*Cardamine flagellifera*	*Cardamine flagellifera*	None	Very Unlikely	
Summer Sedge	*Carex aestivalis*	*Carex aestivalis*	Major	Probable	
A Sedge	*Carex aggregata*	*Carex aggregata*	Minor	Doubtful	
Greenish-White Sedge	*Carex albolutescens*	**Removed from tracking list**	Considerable	Doubtful	
A Sedge	*Carex alopecoidea*	*Carex alopecoidea*	Minor	Doubtful	
Slough Sedge	*Carex atherodes*	*Carex atherodes*	Major	Probable	
A Sedge	*Carex bromoides*	*Carex bromoides*	Major	Probable	
Brown Bog Sedge	*Carex buxbaumii*	*Carex buxbaumii*	Minor	Doubtful	
Hoary Sedge	*Carex canescens*	*Carex canescens*	Major	Probable	
A Sedge	*Carex careyana*	*Carex careyana*	Major	Doubtful	
Bearded Sedge	*Carex comosa*	*Carex comosa*	Considerable	Possible	
Field Sedge	*Carex conoidea*	*Carex conoidea*	None	Very Unlikely	
Davis' Sedge	*Carex davisii*	*Carex davisii*	Minor	Possible	
Ebony Sedge	*Carex eburnea*	*Carex eburnea*	None	Very Unlikely	
Emory's Sedge	*Carex emoryi*	*Carex emoryi*	Considerable	Possible	
Howe's Sedge	*Carex howei*	*Carex atlantica* ssp. *capillacea*	Major	Probable	
Lake Sedge	*Carex lacustris*	*Carex lacustris*	Considerable	Possible	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Wooly Sedge	*Carex lanuginosa*	*Carex pellita*	Considerable	Possible	
A Sedge	*Carex lasiocarpa*	*Carex lasiocarpa*	Major	Possible	
Nerveless Wood Sedge	*Carex leptonervia*	*Carex leptonervia*	Considerable	Probable	
Mead's Sedge	*Carex meadii*	*Carex meadii*	Minor	Doubtful	
A Sedge	*Carex mesochorea*	*Carex mesochorea*	None	Very Unlikely	
Troublesome Sedge	*Carex molesta*	*Carex molesta*	Considerable	Doubtful	
A Sedge	*Carex nigromarginata*	*Carex nigromarginata*	Minor	Doubtful	
Larger Straw Sedge	*Carex normalis*	*Carex normalis*	Minor	Doubtful	
Few-Seeded Sedge	*Carex oligosperma*	**Removed from tracking list**	Major	Possible	
Few-Flowered Sedge	*Carex pauciflora*	*Carex pauciflora*	Major	Present	
A Sedge	*Carex pedunculata*	*Carex pedunculata*	Minor	Doubtful	
Variable Sedge	*Carex polymorpha*	*Carex polymorpha*	Considerable	Possible	C2
A Sedge	*Carex prairea*	*Carex prairea*	None	Very Unlikely	
A Sedge	*Carex projecta*	*Carex projecta*	Minor	Possible	
Weak Stellate Sedge	*Carex seorsa*	**Removed from tracking list**	Major	Possible	
A Sedge	*Carex styloflexa*	*Carex styloflexa*	Major	Possible	
A Sedge	*Carex suberecta*	*Carex suberecta*	Minor	Doubtful	
Rigid Sedge	*Carex tetanica*	*Carex tetanica*	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
A Sedge	*Carex trichocarpa*	*Carex trichocarpa*	Minor	Possible	
A Sedge	*Carex typhina*	*Carex typhina*	Minor	Doubtful	
A Sedge	*Carex woodii*	*Carex woodii*	Minor	Doubtful	
False Pimpernel	*Centunculus minimus*	**Removed from tracking list**	None	Very Unlikely	
Chervil	*Chaerophyllum tainturieri*	**Removed from tracking list**	None	Very Unlikely	
Chestnut Lip Fern	*Cheilanthes castanea*	*Chelianthes eatonii*	None	Very Unlikely	
A Lipfern	*Cheilanthes tomentosa*	*Cheilanthes tomentosa*	None	Very Unlikely	
Standley Goosefoot	*Chenopodium standleyanum*	*Chenopodium standleyanum*	None	Very Unlikely	
Spreading Pogonia	*Cleistes divaricata*	*Cleistes bifaria*	None	Very Unlikely	
White-Haired Leatherflower	*Clematis albicoma*	*Clematis albicoma*	None	Very Unlikely	
Purple Virgin's Bower	*Clematis verticillaris*	*Clematis occidentalis* var. *occidentalis*	Major	Probable	
Harned's Clintonia	*Clintonia alleghaniensis*	*Clintonia alleghaniensis*	Minor	Possible	
Slender Dayflower	*Commelina erecta*	*Commelina erecta*	None	Very Unlikely	
Goldthread	*Coptis groenlandica*	*Coptis trifolia* ssp. *groenlandica*	Major	Very Unlikely	
Early Coralroot	*Corallorrhiza trifida*	*Corallorrhiza trifida*	Major	Possible	
Spring Coralroot	*Corrallorhiza wisteriana*	*Corrallorhiza wisteriana*	Minor	Doubtful	
Star Tickseed	*Coreopsis pubescens*	*Coreopsis pubescens*	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Whorled Tickseed	*Coreopsis verticillata*	*Coreopsis verticillata*	None	Very Unlikely	
Roundleaf Dogwood	*Cornus rugosa*	*Cornus rugosa*	None	Very Unlikely	
Fragile Rockbrake	*Cryptogramma stelleri*	*Cryptogramma stelleri*	Minor	Doubtful	
A Dodder	*Cuscuta indecora*	*Cuscuta indecora*	None	Very Unlikely	
Beaked Dodder	*Cuscuta rostrata*	*Cuscuta rostrata*	Considerable	Probable	
Fraser's Sedge	*Cymophyllus fraseri*	*Cymophyllus fraserianus* **Removed from tracking list**	Considerable	Possible	
A Sedge	*Cyperus inflexus*	*Cyperus squarrosus*	None	Very Unlikely	
A Sedge	*Cyperus refractus*	*Cyperus refractus*	None	Very Unlikely	
Showy Lady's-Slipper	*Cypripedium reginae*	*Cypripedium reginae*	Considerable	Possible	
Star Violet	*Dalibarda repens*	*Dalibarda repens*	Major	Present	
Water Loosestrife	*Decodon verticillatus*	*Decodon verticillatus*	None	Very Unlikely	
Tall Larkspur	*Delphinium exaltatum*	*Delphinium exaltatum*	None	Very Unlikely	C2
Tansy-Mustard	*Descurainia pinnata*	*Descurainia pinnata*	None	Very Unlikely	
A Tick-Trefoil	*Desmodium lineatum*	*Desmodium lineatum*	Minor	Doubtful	
A Tick-Trefoil	*Desmodium pauciflorum*	*Desmodium pauciflorum*	None	Very Unlikely	
American Panic Grass	*Dichanthelium sabulorum* var. *thinium*	*Dichanthelium sabulorum* var. *thinium*	None	Very Unlikely	
Slender Crabgrass	*Digitaria filiformis*	*Digitaria filiformis*	Minor	Doubtful	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Mandarin	*Disporum maculatum*	*Disporum maculatum*	None	Very Unlikely	
Sundew	*Drosera rotundifolia*	*Drosera rotundifolia*	Major	Probable	
Log Fern	*Dryopteris celsa*	**Removed from tracking list**	Minor	Doubtful	
A Spikerush	*Eleocharis compressa*	*Eleocharis compressa*	None	Very Unlikely	
A Spikerush	*Eleocharis engelmannii*	*Eleocharis engelmannii*	Minor	Doubtful	
A Spikerush	*Eleocharis intermedia*	*Eleocharis intermedia*	None	Very Unlikely	
A Spikerush	*Eleocharis palustris*	*Eleocharis palustris*	Considerable	Doubtful	
Squarestem Spikerush	*Eleocharis quadrangulata*	**Removed from tracking list**	None	Very Unlikely	
Beaked Spikerush	*Eleocharis rostellata*	*Eleocharis rostellata*	Considerable	Doubtful	
Nuttall Waterweed	*Elodea nuttallii*	*Elodea nuttallii*	None	Very Unlikely	
Water Horsetail	*Equisetum fluviatile*	*Equisetum fluviatile*	None	Very Unlikely	
Woodland Horsetail	*Equisetum sylvaticum*	*Equisetum sylvaticum*	Considerable	Possible	
A Lovegrass	*Eragrostis hirsuta*	*Eragrostis hirsuta*	None	Very Unlikely	
Yellow Buckwheat	*Eriogonum allenii*	*Eriogonum allenii*	None	Very Unlikely	
Prairie Rocket	**Not on this list**	*Erysimum capitatum*	None	Very Unlikely	
Lesser Snakeroot	*Eupatorium aromaticum*	*Ageratina aromatica* var. *aromatica*	None	Very Unlikely	
Hyssopleaf Throroughwort	*Eupatorium hyssopifolium*	**Removed from tracking list**	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Vervain Thoroughwort	*Eupatorium pilosum*	*Eupatorium pilosum*	Considerable	Possible	
Darlington's Spurge	*Euphorbia purpurea*	*Euphorbia purpurea*	Major	Probable	C2
A Spurge	*Euphorbia vermiculata*	*Chamaesyce vermiculata*	None	Very Unlikely	
A Spurge	*Euphorbia zinniiflora*	*Euphorbia pubentissima*	None	Very Unlikely	
A Sedge	*Fimbristylis annua*	*Fimbristylis annua*	None	Very Unlikely	
Blue Ash	*Fraxinus quadrangulata*	*Fraxinus quadrangulata*	None	Very Unlikely	
Milk Pea	*Galactia volubilis*	*Galactia volubilis*	None	Very Unlikely	
Box Huckleberry	*Gaylussacia brachycera*	*Gaylussacia brachycera*	None	Very Unlikely	
Dwarf Huckleberry	*Gaylussacia dumosa*	*Gaylussacia dumosa*	None	Very Unlikely	
Yellow Gentian	*Gentiana alba*	*Gentiana flavida*	None	Very Unlikely	
Appalachian Gentian	*Gentiana austromontana*	*Gentiana austromontana*	None	Very Unlikely	
Fringed Gentian	*Gentiana crinita*	*Gentianopsis crinita* **Removed from tracking list**	Major	Doubtful	
Purple Avens	*Geum rivale*	*Geum rivale*	Major	Probable	
Yellow Avens	*Geum strictum*	*Geum aleppicum*	Major	Probable	
A Manna-Grass	*Glyceria acutiflora*	*Glyceria acutiflora*	Considerable	Possible	
A Manna-Grass	*Glyceria canadensis* var. *laxa*	*Glyceria laxa*	Major	Probable	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
A Manna-Grass	*Glyceria fernaldii*	*Torreyochloa pallida* var. *fernaldii*	Major	Probable	
A Manna-Grass	*Glyceria grandis*	*Glyceria grandis*	Major	Present	
A Manna-Grass	*Glyceria pallida*	*Torreyochloa pallida* var. *pallida*	Major	Possible	
Appalachian Oak Fern	*Gymnocarpium appalachianum*	*Gymnocarpium appalachianum*	Considerable	Possible	C2
Beargrass	*Gymnopogon ambiguus*	*Gymnopogon ambiguus*	None	Very Unlikely	
Small Purple-Fringed Orchid	*Habenaria psycodes*	*Platanthera psycodes*	Minor	Doubtful	
Long-Bracted Green Orchid	*Habenaria viridis* var. *bracteata*	*Coeloglossum viride* var. *virescens*	Minor	Doubtful	
Canada Frostweed	*Helianthemum canadense*	*Helianthemum canadense*	Minor	Possible	
McDowell Sunflower	*Helianthus dowellianus*	*Helianthus occidentalis* ssp. *occidentalis*	None	Very Unlikely	
Smooth Sunflower	*Helianthus leavigatus*	*Helianthus leavigatus*	None	Very Unlikely	
Ashy Sunflower	*Helianthus mollis*	*Helianthus mollis*	None	Very Unlikely	
Kidneyleaf Mud-Plantain	*Heteranthera reniformis*	*Heteranthera reniformis*	None	Very Unlikely	
White Alumroot	*Heuchera alba*	*Heuchera alba*	Considerable	Probable	
An Alumroot	*Heuchera hispida*	*Heuchera americana* var. *hispida*	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
An Alumroot	*Heuchera longiflora*	*Heuchera longiflora*	None	Very Unlikely	
Crested Coralroot	*Hexalectris spicata*	*Hexalectris spicata*	Major	Doubtful	
Halberd-Leaved Mallow	*Hibiscus militaris*	*Hibiscus laevis*	None	Very Unlikely	
Holy Grass	*Hierochloe odorata*	*Hierochloe odorata*	Major	Doubtful	
False Heather	*Hudsonia tomentosa*	*Hudsonia tomentosa*	Major	Doubtful	
Floating Pennywort	*Hydrocotyle ranunculoides*	*Hydrocotyle ranunculoides*	None	Very Unlikely	
Coppery St. John's-Wort	*Hypericum denticulatum*	*Hypericum denticulatum*	None	Very Unlikely	
Drummond St. John's-Wort	*Hypericum drummondii*	*Hypericum drummondii*	None	Very Unlikely	
	Hypericum mitchellianum	**Removed from tracking list**			
Great St. John's-Wort	*Hypericum pyramidatum*	*Hypericum ascyron* **Removed from tracking list**	None	Very Unlikely	
Large Marsh St. John's-Wort	*Hypericum tubulosum*	*Triadenum tubulosum*	None	Very Unlikely	
Long-Stalked Holly	*Ilex collina*	*Ilex collina*	Minor	Possible	
Blueflag	*Iris versicolor*	**Removed from tracking list**	None	Very Unlikely	
False Rue-Anemone	*Isopyrum biternatum*	*Enemiom biternatum*	None	Very Unlikely	
Butternut	*Juglans cinerea*	*Juglans cinerea*	Minor	Doubtful	C2
Jointed Rush	*Juncus articulatus*	*Juncus articulatus*	Major	Possible	
A Rush	*Juncus balticus*	*Juncus balticus*	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Grass-Leaved Rush	*Juncus biflorus*	*Juncus biflorus*	None	Very Unlikely	
Short-Fruited Rush	*Juncus brachycarpus*	*Juncus brachycarpus*	None	Very Unlikely	
A Rush	*Juncus dichotomus*	*Juncus dichotomus*	Minor	Doubtful	
Thread Rush	*Juncus filiformis*	*Juncus filiformis*	Major	Probable	
Flatleaf Rush	*Juncus platyphyllus*	*Juncus dichotomis* var. *platyphyllus* **Removed from tracking list**	None	Very Unlikely	
A Rush	*Juncus scirpoides*	*Juncus scirpoides*	None	Very Unlikely	
Torrey's Rush	*Juncus torreyi*	*Juncus torreyi*	Considerable	Possible	
Highland Rush	*Juncus trifidus*	*Juncus trifidus*	Considerable	Possible	
One-Flowered Rush	*Juncus trifidus* ssp. *carolinianus*	*Juncus trifidus*	Considerable	Possible	
Ground Cedar	*Juniperus communis*	*Juniperus communis*	None	Very Unlikely	
American Larch	*Larix laricina*	*Larix laricina*	Considerable	Doubtful	
A Pinweed	*Lechea leggettii*	*Lechea pulchella* var. *pulchella*	Considerable	Possible	
Narrow-Leaf	*Lechea tenuifolia*	*Lechea tenuifolia*	Major	Doubtful	
Pale Duckweed	*Lemna valdiviana*	*Lemna valdiviana*	Minor	Possible	
A Lespedeza	*Lespedeza* x *nuttallii*	**Removed from tracking list**	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Recurved Fetterbush	*Leucothoe recurva*	*Leucothoe recurva*	None	Very Unlikely	
New England Blazing Star	*Liatris novae-angliae*	*Liatris scariosa* var. *nieuwlandii*	None	Very Unlikely	
Carolina Lily	*Lilium michauxii*	*Lilium michauxii*	None	Very Unlikely	
Old-Field Toadflax	*Linaria canadensis*	*Nuttallanthus canadensis*	None	Very Unlikely	
False Pimpernel	*Lindernia anagallidea*	*Lindernia dubia* var. *anagillidea*	None	Very Unlikely	
Twinflower	*Linnaea americana*	*Linnaea borealis* ssp. *longiflora*	Major	Doubtful	
Prairie Flax	*Linum lewisii*	*Linum lewisii* var. *lewisii*	None	Very Unlikely	
Grooved Yellow Flax	*Linum sulcatum*	*Linum sulcatum*	None	Very Unlikely	
Loesel's Twayblade	*Liparis loeselii*	*Liparis loeselii*	None	Very Unlikely	
Heartleaf Twayblade	*Listera cordata*	*Listera cordata* var. *cordata*	Major	Possible	
Kidney-Leaf Twayblade	*Listera smallii*	*Listera smallii*	Major	Possible	
Kalm's Lobelia	*Lobelia kalmii*	*Lobelia kalmii*	None	Very Unlikely	
Fly Honeysuckle	*Lonicera canadensis*	*Lonicera canadensis*	Minor	Probable	
Long-Lobe Arrowhead	*Lophotocarpus calycinus*	*Sagittaria calycina* var. *calycina*	Minor	Possible	
Netted Chainfern	*Lorinseria areolata*	*Woodwardia areolata*	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
A Primrose-Willow	*Ludwigia leptocarpa*	*Ludwigia leptocarpa*	None	Very Unlikely	
Sundial Lupine	*Lupinus perennis*	*Lupinus perennis*	Minor	Doubtful	
Southern Woodrush	*Luzula bulbosa*	*Luzula bulbosa*	None	Very Unlikely	
Rock Clubmoss	*Lycopodium porophilum*	*Huperzia porophila*	Considerable	Doubtful	
Climbing Fern	*Lygodium palmatum*	*Lygodium palmatum*	None	Very Unlikely	
Lowland Loosestrife	*Lysimachia hybrida*	*Lysimachia hybrida*	None	Very Unlikely	
Four-Flowered Loosestrife	*Lysimachia quadriflora*	*Lysimachia quadriflora*	None	Very Unlikely	
Water Loosestrife	*Lysimachia thyrsiflora*	*Lysimachia thyrsiflora*	None	Very Unlikely	
Southern Loosestrife	*Lysimachia tonsa*	*Lysimachia tonsa*	None	Very Unlikely	
Winged-Loosestrife	*Lythrum alatum*	*Lythrum alatum*	None	Very Unlikely	
Barbara's-Buttons	*Marshallia grandiflora*	*Marshallia grandiflora*	None	Very Unlikely	C2
Ostrich Fern	*Matteuccia pensylvanica*	*Matteuccia struthiopteris*	Minor	Possible	
Two-Flower Melic Grass	*Melica mutica*	*Melica mutica*	None	Very Unlikely	
Three-Flower Melic Grass	*Melica nitens*	*Melica nitens*	None	Very Unlikely	
Buckbean	*Menyanthes trifoliata*	*Menyanthes trifoliata*	Minor	Doubtful	
Smokehole Bergamot	*Monarda fistulosa* var. *brevis*	*Monarda fistulosa* ssp. *brevis*	Major	Doubtful	C2
Sweet Pinesap	*Monotropsis odorata*	*Monotropsis odorata*	None	Very Unlikely	C2

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Long-Awn Hairgrass	*Muhlenbergia capillaris*	*Muhlenbergia capillaris*	None	Very Unlikely	
Scorpion-Grass	*Myosotis macrosperma*	*Myosotis macrosperma*	None	Very Unlikely	
American Water-Milfoil	*Myriophyllum exalbescens*	*Myriophyllum sibiricum*	None	Very Unlikely	
Cutleaf Water-Milfoil	*Myriophyllum pinnatum*	**Removed from tracking list**	None	Very Unlikely	
Slender Water Nymph	*Najas gracillima*	*Najas gracillima*	None	Very Unlikely	
Shale Barren Evening Primrose	*Oenothera argillicola*	*Oenothera argillicola*	None	Very Unlikely	
An Evening Primrose	*Oenothera pilosella*	*Oenothera pilosella*	None	Very Unlikely	
Limestone Adders's-Tongue	*Ophioglossum engelmannii*	*Ophioglossum engelmannii*	None	Very Unlikely	
A Mountain Ricegrass	*Oryzopsis asperifolia*	*Oryzopsis asperifolia*	Considerable	Possible	
A Mountain Ricegrass	*Oryzopsis canadensis*	*Oryzopsis canadensis*	Considerable	Possible	
Black-Fruit Mountain Ricegrass	*Oryzopsis racemosa*	*Oryzopsis racemosa*	Minor	Possible	
Canby's Mountain-Lover	*Pachistima canbyi*	*Paxistima canbyi*	None	Very Unlikely	C2
A Panic Grass	*Panicum albemarlense*	*Dichanthelium meridionale*	None	Very Unlikely	
A Panic Grass	*Panicum auburne*	*Dichanthelium acuminatum* var. *acuminatum*	None	Very Unlikely	
A Panic Grass	*Panicum bicknellii* or *boreale*	*Dichanthelium boreale*	None	Very Unlikely	
Wiry Witch Grass	*Panicum flexile*	*Panicum flexile*	None	Very Unlikely	
A Panic Grass	**Not on this list**	*Panicum verrucosum*	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
A Panic Grass	*Panicum xanthophysum*	*Dichanthelium xanthophysum*	Minor	Doubtful	
A Panic Grass	*Panicum yadkinense*	*Dichanthelium dichotomum* **Removed from tracking list**	None	Very Unlikely	
Kidneyleaf Grass-of-Parnassus	*Parnassia asarifolia*	*Parnassia asarifolia*	Considerable	Doubtful	
Largeleaf Grass-of-Parnassus	*Parnassia grandifolia*	*Parnassia grandifolia*	None	Very Unlikely	
Silver Nail-Wort	*Paronychia argyrocoma*	*Paronychia argyrocoma*	Minor	Doubtful	
Virginia Nail-Wort	*Paronychia virginica* var. *virginica*	*Paronychia virginica*	None	Very Unlikely	C2
A Paspalum	*Paspalum pubiflorum*	*Paspalum pubiflorum*	None	Very Unlikely	
A Paspalum	*Paspalum setaceum*	**Removed from tracking list**	Major	Doubtful	
Swamp Lousewort	*Pedicularis lanceolata*	*Pedicularis lanceolata*	Considerable	Doubtful	
Smooth Cliffbrake	*Pellaea glabella*	*Pellaea glabella* var. *glabella*	None	Very Unlikely	
Arrow-Arum	*Peltandra virginica*	*Peltandra virginica*	Considerable	Doubtful	
Prairie-Clover	*Petalostemon multiflorum*	*Dalea multiflora* **Removed from tracking list**	None	Very Unlikely	
Swordleaf Phlox	*Phlox buckleyi*	*Phlox buckleyi*	None	Very Unlikely	
Mountain Fetter-Bush	*Pieris floribunda*	*Pieris floribunda*	None	Very Unlikely	
Red Pine	*Pinus resinosa*	*Pinus resinosa*	None	Very Unlikely	
Camphorweed	*Pluchea camphorata*	**Removed from tracking list**	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Drooping Bluegrass	*Poa saltuensis*	*Poa saltuensis*	Minor	Possible	
Rose Pogonia	*Pogonia ophioglossoides*	*Pogonia ophioglossoides*	Major	Probable	
A Jacob's Ladder	*Polemonium van-bruntiae*	*Polemonium van-bruntiae*	Considerable	Possible	
Crossleaf Milkwort	*Polygala cruciata*	*Polygala cruciata*	Major	Doubtful	
Curtiss Milkwort	*Polygala curtissii*	*Polygala curtissii*	None	Very Unlikely	
Pickerelweed	*Pontederia cordata*	*Pontederia cordata*	None	Very Unlikely	
Balsam Poplar	*Populus balsamifera*	*Populus balsamifera*	Minor	Probable	
Slender Pondweed	*Potamogeton berchtoldii*	*Potamogeton pusillus* var. *tenuissimus*	None	Very Unlikely	
Illinois Pondweed	*Potamogeton illinoensis*	*Potamogeton illinoensis*	None	Very Unlikely	
Spotted Pondweed	*Potamogeton pulcher*	*Potamogeton pulcher*	None	Very Unlikely	
Spiral Pondweed	*Potamogeton spirillus*	*Potamogeton spirillus*	Minor	Doubtful	
Flatstem Pondweed	*Potamogeton zosteriformis*	*Potamogeton zosteriformis*	None	Very Unlikely	
Tall Cinquefoil	*Potentilla arguta*	**Removed from tracking list**	None	Very Unlikely	
Three-Toothed Cinquefoil	*Potentilla tridentata*	*Sibbaldiopsis tridentata*	Major	Probable	
Nodding Rattlesnake-Root	*Prenanthes crepidinea*	*Prenanthes crepidinea*	None	Very Unlikely	
Alleghany Plum	*Prunus alleghaniensis*	*Prunus alleghaniensis*	None	Very Unlikely	C2
Chickasaw Plum	*Prunus angustifolia*	*Prunus angustifolia*	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Sand Cherry	*Prunus pumila*	*Prunus pumila*	None	Very Unlikely	
Harperella	*Ptilimnium nodosum*	*Ptilimnium nodosum*	None	Very Unlikely	E
Basil Mountain-Mint	*Pycnanthemum clinopodioides*	*Pycnanthemum clinopodioides*	None	Very Unlikely	
Loomis's Mountain-Mint	*Pycnanthemum loomisii*	*Pycnanthemum loomisii*	None	Very Unlikely	
Single-Haired Mountain-Mint	*Pycnanthemum montanum*	*Pycnanthemum montanum*	None	Very Unlikely	
Blunt Mountain-Mint	*Pycnanthemum muticum*	*Pycnanthemum muticum*	Considerable	Possible	
Hairy Mountain-Mint	*Pycnanthemum pilosum*	*Pycnanthemum verticillatum* var. *pilosum* **Removed from tracking list**	None	Very Unlikely	
Hoary Mountain-Mint	*Pycnanthemum puberulum*	*Pycnanthemum incanum* var. *puberulum*	None	Very Unlikely	
Torrey Mountain-Mint	*Pycnanthemum torrei*	*Pycnanthemum torrei*	None	Very Unlikely	
Greenish-Flowered Wintergreen	*Pyrola virens*	*Pyrola chlorantha* **Removed from tracking list**	None	Very Unlikely	
Shumard Oak	*Quercus shumardii*	*Quercus shumardii*	None	Very Unlikely	
Carolina Buttercup	*Ranunculus carolinianus*	*Ranunculus hipidus* var. *nitidus* **Removed from tracking list**	None	Very Unlikely	
Macoun Buttercup	*Ranunculus macounii*	*Ranunculus macounii*	None	Very Unlikely	
Bristly Crowfoot	*Ranunculus pensylvanicus*	*Ranunculus pensylvanicus*	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Low Spearwort	*Ranunculus pusillus*	*Ranunculus pusillus*	Minor	Doubtful	
Creeping Spearwort	*Ranunculus reptans*	*Ranunculus flammula* var. *nitidus* **Removed from tracking list**	Minor	Doubtful	
Cursed Crowfoot	*Ranunculus sceleratus*	*Ranunculus sceleratus*	None	Very Unlikely	
White Water Crowfoot	*Ranunculus trichophyllus*	*Ranunculus trichophyllus*	Minor	Doubtful	
Alder-Leaved Buckthorn	*Rhamnus alnifolia*	*Rhamnus alnifolia*	Considerable	Possible	
Lance-Leaved Buckthorn	*Rhamnus lanceolata*	*Rhamnus lanceolata*	None	Very Unlikely	
Maryland Meadow Beauty	*Rhexia mariana*	*Rhexia mariana*	None	Very Unlikely	
Swamp Azalea	*Rhododendron viscosum*	*Rhododendron viscosum*	None	Very Unlikely	
Poison Sumac	*Rhus vernix*	*Toxicodendron vernix*	Minor	Doubtful	
A Beaked-Rush	*Rhynchospora globularis*	*Rhynchospora globularis*	None	Very Unlikely	
Smooth Gooseberry	*Ribes hirtellum*	*Ribes hirtellum*	None	Very Unlikely	
Bristly Black Currant	*Ribes lacustre*	*Ribes lacustre*	Minor	Possible	
Missouri Gooseberry	*Ribes missouriense*	*Ribes missouriense*	None	Very Unlikely	
Swamp Red Currant	*Ribes triste*	*Ribes triste*	Minor	Possible	
Prickly Rose	*Rosa acicularis*	*Rosa acicularis*	None	Very Unlikely	
Smooth Rose	*Rosa blanda*	*Rosa blanda*	None	Very Unlikely	
Brilliant Coneflower	*Rudbeckia fulgida*	*Rudbeckia fulgida*	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Sessile-Fruited Arrowhead	*Sagittaria rigida*	*Sagittaria rigida*	None	Very Unlikely	
Glaucous Willow	*Salix discolor*	*Salix discolor*	Considerable	Probable	
Shining Willow	*Salix lucida*	*Salix lucida*	Minor	Doubtful	
Water Pimpernel	*Samolus parviflorus*	*Samolus valerandi* ssp. *parviflorus*	None	Very Unlikely	
Carolina Saxifrage	*Saxifraga caroliniana*	*Saxifraga caroliniana*	None	Very Unlikely	C2
Michaux Saxifrage	*Saxifraga michauxii*	*Saxifraga michauxii*	Minor	Doubtful	
Swamp Saxifrage	*Saxifraga pensylvanica*	*Saxifraga pensylvanica*	Major	Probable	
Pod Grass	*Scheuzeria palustris*	**Removed from tracking list**	Major	Doubtful	
False Melic	*Schizachne purpurascens*	*Schizachne purpurascens*	Major	Doubtful	
A Bullrush	*Scirpus acutus*	*Scirpus acutus*	None	Very Unlikely	
Northeastern Bullrush	*Scirpus ancistrochaetus*	*Scirpus ancistrochaetus*	None	Very Unlikely	E
Black-Girdle Bullrush	*Scirpus atrocinctus*	*Scirpus atrocinctus*	Major	Present	
A Bullrush	*Scirpus purshianus*	*Scirpus purshianus*	Considerable	Very Unlikely	
A Woolgrass	*Scirpus rubrotinctus*	*Scirpus microcarpus*	Major	Probable	
Torrey's Bullrush	*Scirpus torreyi*	**Removed from tracking list**	Minor	Doubtful	
A Bullrush	*Scirpus verecundus*	*Scirpus verecundus*	None	Very Unlikely	
Nutrush	*Scleria triglomerata*	*Scleria triglomerata*	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Hooded Skullcap	*Scutellaria epilobiifolia*	*Scutellaria galericulata*	None	Very Unlikely	
Heart-Leaved Skullcap	*Scutellaria ovata*	**Removed from tracking list**	None	Very Unlikely	
A Heart-Leaved Skullcap	*Scutellaria ovata* ssp. *pseudoarguta*	*Scutellaria ovata* ssp. *pseudoarguta*	None	Very Unlikely	C2
Rock Skullcap	*Scutellaria saxatilis*	*Scutellaria saxatilis*	Minor	Possible	
Pussytoes Ragwort	*Senecio antennariifolius*	*Senecio antennariifolius*	None	Very Unlikely	
Balsam Squaw-Weed	*Senecio pauperculus*	*Senecio pauperculus*	None	Very Unlikely	
Prairie Ragwort	*Senecio plattensis*	*Senecio plattensis*	None	Very Unlikely	
Mullein Foxglove	*Seymeria macrophylla*	*Dasistoma macrophylla*	None	Very Unlikely	
Virginia Mallow	*Sida hermaphrodita*	*Sida hermaphrodita*	None	Very Unlikely	
Snowy Campion	*Silene nivea*	*Silene nivea*	None	Very Unlikely	
Roundleaf Catchfly	*Silene rotundifolia*	*Silene rotundifolia*	None	Very Unlikely	
Robust Fire Pink	*Silene virginica* var. *robusta*	*Silene virginica* var. *robusta*	Minor	Doubtful	C2
Rosinweed	*Silphium compositum*	*Silphium compositum*	None	Very Unlikely	
Starflower False Solomon's-Seal	*Smilacina stellata*	*Maianthemum stellatum*	Considerable	Possible	
Shale Barren Goldenrod	*Solidago arguta* var. *harrisii*	*Solidago arguta* var. *harrisii*	None	Very Unlikely	
Roundleaf Goldenrod	*Solidago patula*	*Solidago patula*	None	Very Unlikely	
Rand's Goldenrod	*Solidago randii*	*Solidago simplex* var. *randii*	Minor	Doubtful	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Sticky Goldenrod	*Solidago simplex* ssp. *randii* var. *racemosa*	*Solidago simplex* ssp. *randii* var. *racemosa*	None	Very Unlikely	
Staminate Burreed	*Sparganium androcladum*	*Sparganium androcladum*	Considerable	Possible	
Virginia Spiraea	*Spiraea virginiana*	*Spiraea virginiana*	None	Very Unlikely	T
Lesser Ladies'-Tresses	*Spiranthes ovalis*	**Removed from tracking list**	None	Very Unlikely	
Little Ladies'-Tresses	*Spiranthes tuberosa*	*Spiranthes tuberosa*	None	Very Unlikely	
A Dropseed	*Sporobolus clandestinus*	*Sporobolus clandestinus*	None	Very Unlikely	
Rough Hedge-Nettle	*Stachys aspera*	*Stachys hyssopifolia* var. *ambigua* **Removed from tracking list**	None	Very Unlikely	
Hispid Hedge-Nettle	*Stachys hispida*	*Stachys tenuifolia* var. *tenuifolia*	None	Very Unlikely	
A Hedge-Nettle	*Stachys nuttallii*	*Stachys nuttallii*	None	Very Unlikely	
Northern Stitchwort	*Stellaria calycantha*	*Stellaria borealis* ssp. *borealis*	Major	Probable	
Blackseed Needlegrass	*Stipa avenacea*	*Piptochaetium avenaceum*	None	Very Unlikely	
Snowberry	*Symphoricarpos albus*	*Symphoricarpos albus*	None	Very Unlikely	
Guyandotte Beauty	*Synandra hispidula*	*Synandra hispidula*	None	Very Unlikely	
Mountain Pimpernel	*Pseudotaenidia*	*Taenidia montana*	None	Very Unlikely	
Roundleaf Fameflower	*Talinum teretifolium*	*Talinum teretifolium*	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Mountain Meadow-Rue	*Thalictrum clavatum*	*Thalictrum clavatum*	None	Very Unlikely	
Steele's Meadow-Rue	*Thalictrum steeleanum*	**Removed from tracking list**	None	Very Unlikely	
Bog Fern	*Thelypteris simulata*	*Thelypteris simulata*	Considerable	Possible	
Arbor-Vitae	*Thuja occidentalis*	*Thuja occidentalis*	None	Very Unlikely	
Sticky False-Asphodel	*Tofieldia glutinosa*	*Tofieldia glutinosa*	Considerable	Doubtful	
Auricled Gerardia	*Tomanthera auriculata*	*Agalinis auriculata*	None	Very Unlikely	C2
Filmy Fern	*Trichomanes boschianum*	*Trichomanes boschianum*	None	Very Unlikely	
Narrow-Leaved Blue Curls	*Trichostema setaceum*	*Trichostema setaceum*	None	Very Unlikely	
Running Buffalo Clover	*Trifolium stoloniferum*	*Trifolium stoloniferum*	Considerable—positive	Possible	E
Kates Mountain Clover	*Trifolium virginicum*	*Trifolium virginicum*	None	Very Unlikely	
Nodding Trillium	*Trillium cernuum*	*Trillium cernuum*	None	Very Unlikely	
Drooping Trillium	*Trillium flexipes*	*Trillium flexipes*	None	Very Unlikely	
Snow Trillium	*Trillium nivale*	*Trillium nivale*	Considerable	Doubtful	
Dwarf Trillium	*Trillium pusillum* var. *monticulum*	*Trillium pusillum* var. *monticulum*	None	Very Unlikely	C2
Nodding Pogonia	*Triphora trianthophora*	*Triphora trianthophora*	Considerable	Doubtful	
Horned Bladderwort	*Utricularia cornuta*	**Removed from tracking list**	Minor	Doubtful	
Hiddenfruit Bladderwort	*Utricularia geminiscapa*	*Utricularia geminiscapa*	Minor	Doubtful	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Humped Bladderwort	*Utricularia gibba*	*Utricularia gibba*	Minor	Doubtful	
Greater Bladderwort	*Utricularia vulgaris*	*Utricularia macrorhiza*	Minor	Doubtful	
Squaw Huckleberry	*Vaccinium caesium*	*Vaccinium stamineum* **Removed from tracking list**	None	Very Unlikely	
Large Cranberry	*Vaccinium macrocarpon*	*Vaccinium macrocarpon*	Considerable	Probable	
Small Cranberry	*Vaccinium oxycoccos*	*Vaccinium oxycoccos*	Considerable	Probable	
Beaked Corn-Salad	*Valerianella radiata*	*Valerianella radiata*	None	Very Unlikely	
Broad-Leaved Ironweed	*Vernonia glauca*	*Vernonia glauca*	None	Very Unlikely	
Marsh Speedwell	*Veronica scutellata*	*Veronica scutellata*	Considerable	Probable	
Downy Arrow-Wood	*Viburnum rafinesquianum*	*Viburnum rafinesquianum*	None	Very Unlikely	
Highbush Cranberry	*Viburnum trilobum*	*Viburnum opulus* var. *americanum*	Minor	Possible	
Appalachian Blue Violet	*Viola appalachiensis*	*Viola appalachiensis*	Considerable	Possible	
Large-Leaf White Violet	*Viola incognita*	*Viola blanda* var. *palustriformis*	Minor	Doubtful	
Northern Bog Violet	*Viola nephrophylla*	*Viola nephrophylla*	Considerable	Doubtful	
Northern Blue Violet	*Viola septentrionalis*	*Viola septentrionalis*	Considerable	Doubtful	
Three-Parted Violet	*Viola tripartita*	*Viola tripartita*	None	Very Unlikely	
Pigeon Grape	*Vitis cinerea*	*Vitis cinerea*	None	Very Unlikely	

* See key on page 9-III-2

Table III-B (Continued)

Common Name	Scientific Name (Strausbaugh & Core)	Scientific Name (WV Heritage Prog./Kartesz)	Probable Impact	Likelihood of Occurrence	Federal Ranking *
Muscadine Grape	*Vitis rotundifolia*	*Vitis rotundifolia*	None	Very Unlikely	
Appalachian Shoestring Fern	*Vittaria appalachiana*	*Vittaria appalachiana*	Minor	Possible	
Columbia Water-Meal	*Wolffia columbiana*	*Wolffia columbiana*	None	Very Unlikely	
Watermeal	*Wolffia papulifera*	*Wolffia brasiliensis* **Removed from tracking list**	None	Very Unlikely	
Dotted Water-Meal	*Wolffia punctata*	*Wolffia brasiliensis* **Removed from tracking list**	None	Very Unlikely	
Rusty Woodsia	*Woodsia ilvensis*	*Woodsia ilvensis*	None	Very Unlikely	
Allegheny Cliff Fern	*Woodsia scopulina*	*Woodsia scopulina* ssp. *scopulina*	None	Very Unlikely	
Eastern Turkeybeard	*Xerophyllum asphodeloides*	*Xerophyllum asphodeloides*	Considerable	Doubtful	
Yellow-Eyed Grass	*Xyris torta*	*Xyris torta*	Considerable	Possible	
Horned Pondweed	*Zannichellia palustris*	*Zannichellia palustris*	None	Very Unlikely	
White Camas	*Zigadenus elegans* ssp. *glaucus*	*Zigadenus elegans* ssp. *glaucus*	Minor	Doubtful	
Oceanorus	*Zigadenus leimanthoides*	*Zigadenus leimanthoides*	Major	Present	
	Zizania aquatica				

* See key on page 9-III-2

APPENDIX IV

Zoological Species of Concern

A. Endangered, Threatened and Sensitive Zoological Species in the Monongahela National Forest and Likelihood of Occurrence in the Dolly Sods Wilderness.

B. Rare Zoological Species in West Virginia and Likelihood of Occurrence in the Dolly Sods Wilderness.

C. Biological Evaluation of Effects on Endangered, Threatened, and Sensitive Animal Species in the Ordnance Removal Project in the Dolly Sods Wilderness.

Table IV-A
Endangered, Threatened and Sensitive Zoological Species in the Monongahela National Forest and Likelihood of Occurrence in the Dolly Sods Wilderness

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
MAMMALS			
Gray Wolf	*Canis lupus*	None	Very Unlikely
Virginia Big-Eared Bat	*Plecotus townsendii*	None	Very Unlikely
Eastern Cougar	*Felis concolor couguar*	None	Very Unlikely
Virginia Northern Flying Squirrel	*Glaucomys sabrinus fuscus*	Minor	Present
Indiana Bat	*Myotis sodalis*	None	Very Unlikely
Southern Rock Vole	*Microtus chrotorrhinus carolinensis*	Minor	Possible
Eastern Small-Footed Bat	*Myotis leibii*	None	Very Unlikely
Allegheny Woodrat	*Neotoma magister*	Minor	Probable
Appalachian/Southern Water Shrew	*Sorex palustris punctulatus*	Minor	Possible
Appalachian Cottontail	*Sylvilagus obscurus*	Minor	Probable
BIRDS			
Northern Goshawk	*Accipiter gentilis*	Minor	Possible
Cerulean Warbler	*Dendroica cerulea*	None	Doubtful
American Peregrine Falcon	*Falco peregrinus anatum*	Minor	Doubtful
Bald Eagle	*Haliaeetus leucocephalus*	None	Very Unlikely

* Inadequate Information

Table IV-A (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
AMPHIBIANS			
Cheat Mountain Salamander	*Plethodon nettingi*	Major	Present
Green Salamander	*Aenides aeneus*	Minor	Possible
Hellbender	*Cryptobranchus alleganiensis*	None	Very Unlikely
FISH			
Candy Darter	*Etheostoma osburni*	None	Very Unlikely
Kanawha Minnow	*Phenacobius teretulus*	None	Very Unlikely
Cheat Minnow	*Rhinichthys bowersi*	Minor	Possible
INVERTEBRATE SPECIES			
Cheat Valley Cave Isopod	*Caecidotea cannulus*	None	Very Unlikely
Holsinger's/Greenbrier Valley Cave Isopod	*Caecidotea holsingeri*	None	Very Unlikely
Organ Cave Snail	*Fontigens tartarea*	None	Very Unlikely
Green Floater	*Lasmigona subviridis*	None	Very Unlikely
A Spider	*Phanetta subterranea*	None	Very Unlikely
Dry Fork Valley Cave Beetle	*Pseudanophthalmus montanus*	None	Very Unlikely
West Virginia Blind Cave Millipede	*Trichopetalum krekeleri*	None	Very Unlikely

* Inadequate Information

Table IV-B
Rare Zoological Species in the West Virginia and Likelihood of Occurrence in the Dolly Sods Wilderness

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
VERTEBRATE SPECIES			
Northern Goshawk	*Accipiter gentilis*	Minor	Possible
Blanchard's Cricket Frog	*Acris crepitans blanchardi*	None	Very Unlikely
Northern Cricket Frog	*Acris crepitans crepitans*	None	Very Unlikely
Northern Saw-Whet Owl	*Aegolius acadicus*	Minor	Possible
Bachman's Sparrow	*Aimophila aestivalis*	None	Very Unlikely
Jefferson Salamander	*Ambystoma jeffersonianum*	Minor	Possible
Marbled Salamander	*Ambystoma opacum*	None	Very Unlikely
Smallmouth Salamander	*Ambystoma texanum*	None	Very Unlikely
Black Bullhead	*Ameiurus melas*	None	Very Unlikely
Crystal Darter	*Ammocrypta asprella*	None	Very Unlikely
Eastern Sand Darter	*Ammocrypta pellucida*	None	Very Unlikely
Henslow's Sparrow	*Ammodramus henslowii*	None	Very Unlikely
Blue-Winged Teal	*Anas discors*	None	Very Unlikely
American Black Duck	*Anas rubripes*	Minor	Doubtful
Green Salamander	*Aneides aeneus*	Minor	Possible
American Eel	*Anguilla rostrata*	None	Very Unlikely
Golden Eagle	*Aquila chrysaetos*	None	Very Unlikely

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
VERTEBRATE SPECIES (cont.')			
Great Blue Heron	*Ardea herodias*	None	Possible
Long-Eared Owl	*Asio otus*	None	Possible
Upland Sandpiper	*Bartramia longicauda*	None	Very Unlikely
American Bittern	*Botaurus lentiginosus*	None	Very Unlikely
Chuck-Will's-Widow	*Caprimulgus carolinensis*	None	Very Unlikely
Pine Siskin	*Carduelis pinus*	None	Very Unlikely
River Carpsucker	*Carpiodes carpio*	None	Very Unlikely
Highfin Carpsucker	*Carpiodes velifer*	None	Very Unlikely
Swainson's Thrush	*Catharus ustulatus*	None	Possible
Lark Sparrow	*Chondestes grammacus*	None	Very Unlikely
Northern Harrier	*Circus cyaneus*	None	Very Unlikely
Marsh Wren	*Cistothorus palustris*	None	Very Unlikely
Sedge Wren	*Cistothorus platensis*	None	Very Unlikely
Spotted Turtle	*Clemmys guttata*	None	Very Unlikely
Wood Turtle	*Clemmys insculpta*	None	Very Unlikely
Redside Dace	*Clinostomus elongatus*	None	Very Unlikely
Star-Nosed Mole	*Condylura cristata*	Minor	Possible
Olive-Sided Flycatcher	*Contopus borealis*	None	Possible

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
VERTEBRATE SPECIES (cont.')			
Black Vulture	*Coragyps atratus*	None	Possible
Fish Crow	*Corvus ossifragus*	None	Very Unlikely
Banded Sculpin	*Cottus carolinae*	None	Very Unlikely
Slimy Sculpin	*Cottus cognatus*	None	Very Unlikely
Potomac Sculpin	*Cottus girardi*	None	Very Unlikely
Bluestone Sculpin	*Cottus* sp 1	None	Very Unlikely
Hellbender	*Cryptobranchus alleganiensis*	None	Very Unlikely
Blue Sucker	*Cycleptus elongatus*	None	Very Unlikely
Satinfin Shiner	*Cyprinella analostana*	None	Very Unlikely
Cerulean Warbler	*Dendroica cerulea*	None	Very Unlikely
Yellow-Rumped Warbler	*Dendroica coronata*	None	Possible
Blackbelly Salamander	*Desmognathus quadramaculatus*	None	Very Unlikely
Bobolink	*Dolichonyx oryzivorus*	None	Possible
Corn Snake	*Elaphe guttata guttata*	None	Very Unlikely
Alder Flycatcher	*Empidonax alnorum*	None	Possible
Creek Chubsucker	*Erimyzon oblongus*	None	Very Unlikely
Chain Pickerel	*Esox niger*	None	Very Unlikely
Bluebreast Darter	*Etheostoma camurum*	None	Very Unlikely

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
VERTEBRATE SPECIES (cont.')			
Longfin Darter	*Etheostoma longimanum*	None	Very Unlikely
Spotted Darter	*Etheostoma maculatum*	None	Very Unlikely
Tessellated Darter	*Etheostoma olmstedi*	None	Very Unlikely
Candy Darter	*Etheostoma osburni*	None	Very Unlikely
Tippecanoe Darter	*Etheostoma tippecanoe*	None	Very Unlikely
Coal Skink	*Eumeces anthracinus anthracinus*	None	Very Unlikely
Broadhead Skink	*Eumeces laticeps*	None	Very Unlikely
Cave Salamander	*Eurycea lucifuga*	None	Very Unlikely
Tonguetied Minnow	*Exoglossum laurae*	None	Very Unlikely
Peregrine Falcon	*Falco peregrinus*	Minor	Doubtful
Eastern Cougar	*Felis concolor couguar*	None	Very Unlikely
American Coot	*Fulica americana*	None	Very Unlikely
Banded Killifish	*Fundulus diaphanus*	None	Very Unlikely
Common Snipe	*Gallinago gallinago*	None	Possible
Common Moorhen	*Gallinula chloropus*	None	Very Unlikely
Northern Flying Squirrel	*Glaucomys sabrinus fuscus*	Minor	Present
Map Turtle	*Graptemys geographica*	None	Very Unlikely
Kentucky Spring Salamander	*Gyrinophilus porphyriticus duryi*	None	Very Unlikely
West Virginia Spring Salamander	*Gyrinophilus subterraneus*	None	Very Unlikely

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
VERTEBRATE SPECIES (cont.')			
Bald Eagle	*Haliaeetus leucocephalus*	None	Very Unlikely
Goldeye	*Hiodon alosoides*	None	Very Unlikely
Mooneye	*Hiodon tergisus*	None	Very Unlikely
Cliff Swallow	*Hirundo pyrrhonota*	None	Very Unlikely
Eastern Silvery Minnow	*Hybognathus regius*	None	Very Unlikely
Cope's Gray Treefrog	*Hyla chrysoscelis*	None	Very Unlikely
Ohio Lamprey	*Ichthyomyzon bdellium*	None	Very Unlikely
Northern Brook Lamprey	*Ichthyomyzon fossor*	None	Very Unlikely
Mountain Brook Lamprey	*Ichthyomyzon greeleyi*	None	Very Unlikely
Silver Lamprey	*Ichthyomyzon unicuspis*	None	Very Unlikely
Bigmouth Buffalo	*Ictiobus cyprinellus*	None	Very Unlikely
Black Buffalo	*Ictiobus niger*	None	Very Unlikely
Least Bittern	*Ixobrychus exilis*	None	Very Unlikely
Least Brook Lamprey	*Lampetra aepyptera*	None	Very Unlikely
American Brook Lamprey	*Lampetra appendix*	None	Very Unlikely
Migrant Loggerhead Shrike	*Lanius ludovicianus migrans*	None	Very Unlikely
Silver-Haired Bat	*Lasionycteris noctivagans*	None	Very Unlikely
Warmouth	*Lepomis gulosus*	None	Very Unlikely
Orangespotted Sunfish	*Lepomis humilis*	None	Very Unlikely

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
VERTEBRATE SPECIES (cont.')			
Swainson's Warbler	*Limnothlypis swainsonii*	None	Very Unlikely
Hooded Merganser	*Lophodytes cucullatus*	None	Very Unlikely
Red Crossbill	*Loxia curvirostra*	None	Doubtful
River Otter	*Lutra canadensis*	None	Very Unlikely
Common Shiner	*Luxilus cornutus*	None	Very Unlikely
Rosefin Shiner	*Lythrurus ardens*	None	Very Unlikely
Redfin Shiner	*Lythrurus umbratilis*	None	Very Unlikely
Speckled Chub	*Macrhybopsis aestivalis*	None	Very Unlikely
Silver Chub	*Macrhybopsis storeriana*	None	Very Unlikely
Pearl Dace	*Margariscus margarita*	None	Very Unlikely
Fisher	*Martes pennanti*	None	Possible
Red-Headed Woodpecker	*Melanerpes erythrocephalus*	None	Very Unlikely
Southern Rock Vole	*Microtus chrotorrhinus carolinensis*	Minor	Possible
Prairie Vole	*Microtus ochrogaster*	None	Very Unlikely
Torrent Sucker	*Moxostoma rhothoecum*	None	Very Unlikely
Grey Bat	*Myotis grisescens*	None	Very Unlikely
Eastern Small-Footed Bat	*Myotis leibii*	None	Very Unlikely
Northern Long-Eared Bat	*Myotis septentrionalis*	None	Very Unlikely

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
VERTEBRATE SPECIES (cont.')			
Indiana Bat	*Myotis sodalis*	None	Very Unlikely
Bluehead Chub	*Nocomis leptocephalus*	None	Very Unlikely
Bigmouth Chub	*Nocomis platrhynchus*	None	Very Unlikely
Comely Shiner	*Notropis amoenus*	None	Very Unlikely
Popeye Shiner	*Notropis ariommus*	None	Very Unlikely
River Shiner	*Notropis blennius*	None	Very Unlikely
Ghost Shiner	*Notropis buchanani*	None	Very Unlikely
Swallowtail Shiner	*Notropis procne*	None	Very Unlikely
New River Shiner	*Notropis scabriceps*	None	Very Unlikely
Mountain Madtom	*Notorus eleutherus*	None	Very Unlikely
Northern Madtom	*Notorus stigmosus*	None	Very Unlikely
Evening Bat	*Nycticeius humeralis*	None	Very Unlikely
Golden Mouse	*Ochrotomys nuttalli*	None	Very Unlikely
Mourning Warbler	*Oporornis philadelphia*	None	Very Unlikely
Osprey	*Pandion haliaetus*	None	Very Unlikely
Channel Darter	*Percina copelandi*	None	Very Unlikely
Gilt Darter	*Percina evides*	None	Very Unlikely
Appalachia Darter	*Percina gymnocephala*	None	Very Unlikely
Longhead Darter	*Percina macrocephala*	None	Very Unlikely

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
VERTEBRATE SPECIES (cont.')			
Stripeback Darter	*Percina notogramma*	None	Very Unlikely
Shield Darter	*Percina peltata*	None	Very Unlikely
Dusky Darter	*Percina sciera*	None	Very Unlikely
River Darter	*Percina shumardi*	None	Very Unlikely
Suckermouth Minnow	*Phenacobius mirabilis*	None	Very Unlikely
Kanawha Minnow	*Phenacobius teretulus*	None	Very Unlikely
Southern Redbelly Dace	*Phoxinus erythrogaster*	None	Very Unlikely
Mountain Redbelly Dace	*Phoxinus oreas*	None	Very Unlikely
Bullhead Minnow	*Pimephales vigilax*	None	Very Unlikely
Pine Snake	*Pituophis melanoleucus melanoleucus*	None	Very Unlikely
Eastern Big-Eared Bat	*Plecotus rafinesquii*	None	Very Unlikely
Virginia Big-Eared Bat	*Plecotus townsendii virginianus*	None	Very Unlikely
Cumberland Plateau Salamander	*Plethedon kentucki*	None	Very Unlikely
Cheat Mountain Salamander	*Plethodon nettingi*	Major	Present
White-Spotted Salamander	*Plethodon punctatus*	None	Very Unlikely
Pied-Billed Grebe	*Podilymbus podiceps*	None	Very Unlikely
Paddlefish	*Polyodon spathula*	None	Very Unlikely
Sora	*Porzana carolina*	None	Possible

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
VERTEBRATE SPECIES (cont.')			
Prothonotary Warbler	*Protonotaria citrea*	None	Very Unlikely
Upland Chorus Frog	*Pseudacris triseriata feriarum*	None	Very Unlikely
Eastern River Cooter	*Pseudemys concinna concinna*	None	Very Unlikely
Hieroglyphic Turtle	*Pseudemys concinna hieroglyphica*	None	Very Unlikely
Redbelly Turtle	*Pseudemys rubriventris*	None	Very Unlikely
King Rail	*Rallus elegans*	None	Very Unlikely
Virginia Rail	*Rallus limicola*	None	Very Unlikely
Northern Leopard Frog	*Rana pipiens*	None	Very Unlikely
Eastern Harvest Mouse	*Reithrodontomys humulis*	None	Very Unlikely
Cheat Minnow	*Rhinichthys bowersi*	Minor	Possible
Bank Swallow	*Riparia riparia*	None	Very Unlikely
Eastern Mole	*Scalopus aquaticus*	None	Very Unlikely
Eastern Spadefoot Toad	*Scaphiopus holbrookii*	None	Very Unlikely
Long-Tailed Shrew	*Sorex dispar*	None	Very Unlikely
Pygmy Shrew	*Sorex hoyi winnemana*	None	Very Unlikely
Southeastern Shrew	*Sorex longirostris*	None	Very Unlikely
Southern Water Shrew	*Sorex palustris punctulatus*	Minor	Possible
Yellow-Bellied Sapsucker	*Sphyrapicus varius*	None	Very Unlikely
Dickcissel	*Spiza americana*	None	Very Unlikely

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
VERTEBRATE SPECIES (cont.')			
Appalachian Cottontail	*Sylvilagus obscurus*	Minor	Probable
Eastern Ribbon Snake	*Thamnophis sauritus*	None	Very Unlikely
Bewick's Wren	*Thryomanes bewickii altus*	None	Very Unlikely
Red-Eared Slider	*Trachemys scripta*	None	Very Unlikely
Smooth Softshell	*Trionyx muticus muticus*	None	Very Unlikely
Common Barn-Owl	*Tyto alba*	None	Very Unlikely
Central Mudminnow	*Umbra limi*	None	Very Unlikely
Golden-Winged Warbler	*Vermivora chrysoptera*	None	Very Unlikely
Nashville Warbler	*Vermivora ruficapilla*	None	Possible
Mountain Earth Snake	*Virginia valeriae pulchra*	Minor	Possible
Meadow Jumping Mouse	*Zapus hudsonius*	None	Very Unlikely
INVERTEBRATE SPECIES			
A Noctuid Moth	*Agrotis manifesta*	*	*
A Noctuid Moth	*Agrotis stigmosa*	*	*
Elktoe	*Alasmidonta marginata*	None	Very Unlikely
Brook Floater	*Alasmidonta varicosa*	None	Very Unlikely
A Noctuid Moth	*Anaplectoides brunneomedia*	*	*
Flat Floater	*Anodonta suborbiculata*	*	*
Spider	*Anthrobia monmouthia*	*	*

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
INVERTEBRATE SPECIES (cont.')			
A Noctuid Moth	*Aplectoides condita*	*	*
Dry Fork Valley Cave Pseudoscorpion	*Apochthonius paucispinosus*	None	Very Unlikely
Cullembola	*Arrhopalites* sp 2	*	*
Dusted Skipper	*Atrytonopsis hianna*	*	*
Golden-Banded Skipper	*Autochton cellus*	*	*
A Cave Beetle	*Batriasymmodes parki*	None	Very Unlikely
Silver Bordered Fritillary	*Boloria selene myrina*	*	*
Boreal Fan Moth	*Brachionycha borealis*	*	*
An Isopod	*Caecidotea cannulus*	*	*
An Isopod	*Caecidotea franzi*	*	*
Greenbrier Valley Cave Isopod	*Caecidotea holsingeri*	None	Very Unlikely
Price's Cave Isopod	*Caecidotea pricei*	None	Very Unlikely
An Isopod	*Caecidotea simonini*	*	*
An Isopod	*Caecidotea sinuncus*	*	*
Northern Metalmark	*Calephelis borealis*	*	*
New River Riffle Crayfish	*Cambarus chasmodactylus*	None	Very Unlikely
Elk River Crayfish	*Cambarus elkensis*	None	Very Unlikely
Underground Crayfish	*Cambarus nerterius*	None	Very Unlikely
A Crayfish	*Cambarus veteranus*	None	Very Unlikely

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
INVERTEBRATE SPECIES (cont.')			
James Spinymussel	*Canthyria collina*	None	Very Unlikely
A Land Snail	*Carychium clappi*	*	*
Sweet Underwing	*Catocala dulciola*	*	*
Herodias Underwing	*Catocala herodias gerhardi*	*	*
A Noctuid Moth	*Catocala miranda*	*	*
A Noctuid Moth	*Chaetaglaea cerata*	*	*
Royal Syarinid Pseudoscorpion	*Chitrella regina*	*	*
Gorgone Crescentspot	*Chlosyne gorgone*	*	*
Harris' Checkerspot	*Chlosyne harrisii*	*	*
A Tiger Beetle	*Cicindela formosa generosa*	*	*
Cobblestone Tiger Beetle	*Cicindela marginipennis*	*	*
Pink-Edged Sulphur	*Colias interior*	*	*
Gemmed Satyr	*Cyllopsis gemma*	*	*
Fanshell	*Cyprogenia stegaria*	*	*
Six-Banded Longhorn Beetle	*Dryobius sexnotatus*	*	*
Elephantear	*Elliptio crassidens crassidens*	*	*
Northern Lance	*Elliptio fisheriana*	*	*
West Virginia Burrowing Mayfly	*Ephemera triplex*	*	*
Tubercled Blossom	*Epioblasma torulosa*	None	Very Unlikely

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
INVERTEBRATE SPECIES (cont.')			
Northern Rifflesheil	*Epioblasma torulosa rangiana*	None	Very Unlikely
Tuberculed Blossom Pearly	*Epioblasma torulosa torulosa*	None	Very Unlikely
Snuffbox	*Epioblasma triquetra*	None	Very Unlikely
Early Hairstreak	*Erora laeta*	*	*
Columbine Duskywing	*Erynnis lucilius*	*	*
Mottled Duskywing	*Erynnis martialis*	*	*
Olympia Marble	*Euchloe olympia*	*	*
Baltimore	*Euphydryas phaeton*	*	*
Two-Spotted Skipper	*Euphyes bimacula*	*	*
Northern Hairstreak	*Fixsenia favonius ontario*	*	*
Organ Cave Snail	*Fontigens tartarea*	None	Very Unlikely
Greenbrier Cave Snail	*Fontigens turritella*	None	Very Unlikely
Ebony Shell	*Fusconaia ebena*	*	*
Long Solid	*Fusconaia maculata maculata*	*	*
Cave Flatworm	*Geocentrophora cavernicola*	None	Very Unlikely
Maryland Glyph Snail	*Glyphyalinia raderi*	*	*
Elusive or Marked Clubtail	*Gomphus notatus*	*	*
Green-Faced Clubtail	*Gomphus viridifrons*	*	*
A Tiger Moth	*Grammia phyllira*	*	*

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
INVERTEBRATE SPECIES (cont.')			
A Noctuid Moth	*Hadena ectypa*	*	*
Tallus Coil	*Helicodiscus triodus*	*	*
Cherrystone Drop	*Hendersonia occulta*	*	*
Carolina Satyr	*Hermeuptychia sosybius*	*	*
Cobweb Skipper	*Hesperia metea*	*	*
Arbuckle Cave Ground Beetle	*Horologion speokites*	None	Very Unlikely
Frosted Elfin	*Incisalia irus*	*	*
Hoary Elfin	*Incisalia polia*	*	*
Cavern Sheet-Web Spider	*Islandiana speophila*	None	Very Unlikely
Greenbrier Valley Cave Pseudoscorpion	*Kleptochthonius henroti*	None	Very Unlikely
Organ Cave Pseudoscorpion	*Kleptochthonius hetricki*	None	Very Unlikely
Orpheus Cave Pseudoscorpion	*Kleptochthonius orpheus*	None	Very Unlikely
Proserpina Cave Pseudoscorpion	*Kleptochthonius proserpinae*	None	Very Unlikely
Pink Mucket	*Lampsilis abrupta*	None	Very Unlikely
Pocket Book	*Lampsilis ovata*	None	Very Unlikely
Yellow Sandshell	*Lampsilis teres teres*	None	Very Unlikely
Green Floater	*Lasmigona subviridis*	*	*
Black Sandshell	*Ligumia recta*	*	*
A Noctuid Moth	*Lithophane oriunda*	*	*

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
INVERTEBRATE SPECIES (cont.')			
A Pinion Moth	*Lithophane* sp 1	*	*
Bog Copper	*Lycaena epixanthe*	*	*
Hoffmaster's Cave Flatworm	*Macrocotyla hoffmasteri*	None	Very Unlikely
Washboard	*Megalonaias nervosa*	*	*
Doll's Merolonche	*Merolonche dolli*	*	*
Barrens Metarranthis Moth	*Metarranthis apiciaria*	*	*
Threehorn	*Obliquaria reflexa*	*	*
Ring Pink	*Obovaria retusa*	*	*
Alleghany Snaketail Dragonfly	*Ophiogomphus incurvatus alleghaniensis*	None	Possible
Sidelong Supercoil	*Paravitrea ceres*	*	*
Round Supercoil	*Paravitrea reesi*	*	*
Barred Supercoil	*Paravitrea seradens*	*	*
White M Hairstreak	*Parrhasius m-album*	*	*
A Spider	*Phanetta subterranea*	*	*
Tawny Crescent Butterfly	*Phyciodes batesii*	*	*
Northern Pearl Crescent	*Phyciodes selenis*	*	*
Butterfly	*Plagiola lineolata*	*	*
Sheephead	*Plethobasus cyphyus*	*	*

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
INVERTEBRATE SPECIES (cont.')			
Clubshell	*Pleurobema clava*	None	Very Unlikely
Ohio River Pigtoe	*Pleurobema cordatum*	None	Very Unlikely
Round Pigtoe	*Pleurobema sintoxia*	None	Very Unlikely
Diplura	*Plusiocampa fieldingi*	*	*
Diplura	*Plusiocampa* sp 1	*	*
Appalachian Cave Spider	*Porrhomma cavernicolum*	None	Very Unlikely
Ohio Heelsplitter	*Potamilus ohioensis*	None	Very Unlikely
A Cave Beetle	*Pseudanophthalmus fuscus*	None	Very Unlikely
A Cave Beetle	*Pseudanophthalmus grandis*	None	Very Unlikely
A Cave Beetle	*Pseudanophthalmus grandis elevatus*	None	Very Unlikely
A Cave Beetle	*Pseudanophthalmus grandis grandis*	None	Very Unlikely
A Cave Beetle	*Pseudanophthalmus grandis orthosulcatus*	None	Very Unlikely
A Cave Beetle	*Pseudanophthalmus grandis* ssp 1	None	Very Unlikely
Timber Ridge Cave Beetle	*Pseudanophthalmus hadenoecus*	None	Very Unlikely
A Cave Beetle	*Pseudanophthalmus higginbothami*	None	Very Unlikely
A Cave Beetle	*Pseudanophthalmus hypertrichosis*	None	Very Unlikely
Rich Mountain Cave Beetle	*Pseudanophthalmus krekeleri*	None	Very Unlikely

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
INVERTEBRATE SPECIES (cont.')			
Lallemant's Cave Beetle	*Pseudanophthalmus lallemanti*	None	Very Unlikely
Dry Fork Valley Cave Beetle	*Pseudanophthalmus montanus*	None	Very Unlikely
South Branch Valley Cave Beetle	*Pseudanophthalmus potomaca potomaca*	None	Very Unlikely
Seneca Cave Beetle	*Pseudanophthalmus potomaca senecae*	None	Very Unlikely
A Beetle	*Pseudanophthalmus* sp 1	*	*
A Beetle	*Pseudanophthalmus* sp 2	*	*
A Beetle	*Pseudanophthalmus* sp 3	*	*
Greenbrier Valley Cave Beetle	*Pseudanophthalmus subaequalis*	None	Very Unlikely
Gandy Creek Cave Springtail	*Pseudosinella certa*	None	Very Unlikely
A Springtail	*Pseudosinella gisini*	*	*
A Springtail	*Pseudosinella orba*	*	*
Shelled Cave Springtail	*Pseudosinella testa*	None	Very Unlikely
Greenbrier Valley Cave Millipede	*Pseudotremia fulgida*	None	Very Unlikely
Germany Valley Cave Millipede	*Pseudotremia lusciosa*	None	Very Unlikely
South Branch Valley Cave Millipede	*Pseudotremia princeps*	None	Very Unlikely
Grizzled Skipper	*Pyrgus wyandot*	*	*
Monkeyface	*Quadrula metanevra*	*	*

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
INVERTEBRATE SPECIES (cont.')			
Hickory Hairstreak	*Satyrium caryaevorum*	*	*
Edwards' Hairstreak	*Satyrium edwardsii*	*	*
Appalachian Brown	*Satyrodes appalachia*	*	*
Salamander Mussel	*Simpsonaias ambigua*	None	Very Unlikely
Collembola (A Springtail)	*Sinella agna*	*	*
Diana	*Speyeria diana*	*	*
Regal Fritillary	*Speyeria idalia*	*	*
Culver's Planarian	*Sphalloplana culveri*	*	*
Scalloped Sootywing	*Staphylus hayhurstii*	*	*
A Ghost Moth	*Sthenopis auratus*	*	*
Allegheny Cave Amphipod	*Stygobromus allegheniensis*	None	Very Unlikely
Bigger's Cave Amphipod	*Stygobromus biggersi*	None	Very Unlikely
Cooper's Cave Amphipod	*Stygobromus cooperi*	None	Very Unlikely
Culver's Cave Amphipod	*Stygobromus culveri*	None	Very Unlikely
Greenbrier Cave Amphipod	*Stygobromus emarginatus*	None	Very Unlikely
Shenandoah Valley Cave Amphipod	*Stygobromus gracilipes*	None	Very Unlikely
Southwestern Virginia Cave Amphipod	*Stygobromus mackini*	None	Very Unlikely
Morrison's Cave Amphipod	*Stygobromus morrisoni*	None	Very Unlikely
Pocahontas Cave Amphipod	*Stygobromus nanus*	None	Very Unlikely

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
INVERTEBRATE SPECIES (cont.')			
Minute Cave Amphipod	*Stygobromus parvus*	None	Very Unlikely
An Amphipod	*Stygobromus pollostus*	*	*
Redacted Cave Amphipod	*Stygobromus redactus*	None	Very Unlikely
An Amphipod	*Stygobromus* sp 1	*	*
An Amphipod	*Stygobromus* sp 2	*	*
An Amphipod	*Stygobromus* sp 3	*	*
Spring Cave Amphipod	*Stygobromus spinatus*	None	Very Unlikely
An Amphipod	*Stygobromus tenuis potomacus*	*	*
An Oligochaete	*Stylodrilus beatiei*	*	*
Lilliput	*Toxolasma parvus*	*	*
	Trichodrilus culveri	*	*
West Virginia Blind Cave Millipede	*Trichopetalum krekeleri*	None	Very Unlikely
Packard's Blind Cave Millipede	*Trichopetalum packardi*	None	Very Unlikely
Grand Caverns Blind Cave Millipede	*Trichopetalum weyeriensis*	None	Very Unlikely
Luray Caverns Blind Cave Millipede	*Trichopetalum whitei*	None	Very Unlikely
Atlantic Three-Tooth Land Snail	*Triodopsis juxtidens*	*	*
Cheat River Three-Tooth	*Triodopsis platysayoides*	*	*
Fawnsfoot	*Truncilla donaciformis*	*	*
Deertoe	*Truncilla truncata*	*	*

* Inadequate Information

Table IV-B (Continued)

Common Name	Scientific Name	Probable Impact	Likelihood of Occurrence
INVERTEBRATE SPECIES (cont.')			
Pondhorn	*Uniomerus tetralasmus*	*	*
Rayed Bean	*Villosa fabalis*	*	*
Little Spectaclecase	*Villosa lienosa*	*	*
A Noctuid Moth	*Zale calycanthata*	*	*
A Noctuid Moth	*Zale squamularis*	*	*
A Noctuid Moth	*Zale submediana*	*	*

* Inadequate Information

Biological Evaluation of Effects on Endangered, Threatened, and Sensitive Animal Species in the Ordnance Removal Project in the Dolly Sods Wilderness

Introduction

The purpose of this biological evaluation is to review and assess the potential effects of the Ordnance Removal Project in the Dolly Sods Wilderness on endangered, threatened, and sensitive animal species.

This document is part of the environmental assessment and contains information relative to the location of endangered, threatened and sensitive animal species. Threatened and endangered zoological species are designated by the Secretary of Interior and the Secretary of Commerce. These species are protected under the Endangered Species Act of 1973. Sensitive zoological species are those identified by the United States Forest Service Regional Forester for which population viability is a concern. The Regional Forester for Region 9 has developed a list of sensitive species that occur in the Monongahela National Forest. The objectives of this policy are to: (1) provide a means of preventing species from becoming federally listed as endangered or threatened; and (2) provide a basis for establishing sound management priorities for all wildlife and plants in the National Forest.

To determine which of the endangered, threatened, and sensitive species could be negatively impacted by the Ordnance Removal Project in the Proposed Action and Alternatives, the following "Likelihood of Occurrence" table was completed. All endangered, threatened and sensitive species known to occur in the Monongahela National Forest are listed in Table 1. Table 1 also lists the status of each endangered, threatened, and sensitive species and the habitat requirements. Data included on Table 1 were provided by the Natural Heritage Program of the West Virginia Division of Natural Resources, personal communication with endangered, threatened, and sensitive species specialists, natural history clubs, and research literature.

Proposed Action and Alternatives

The Proposed Action is designed for the purpose of removing ordnance from the Dolly Sods Wilderness Area. It is the intent of the Proposed Action to remediate hiking trails and campsites. Areas 20 feet on either side of each hiking trail will be searched and remediated. Campsites will also be searched and remediated. Ordnance will be detonated in place and no woody vegetation will be removed. There are two alternatives. These include Alternative Number 2 which proposes to search and remediate areas 20 feet on either side of each hiking trail, but not the campsites. Alternative Number 3 is a No Action Alternative, i.e., to not remove the ordnance. The action taken to locate and detonate the ordnance for the Proposed Action and the second alternative will be the same (as described in the Environmental Assessment).

Biological Evaluation

Findings and Effects—Threatened and Endangered Species

The Likelihood of Occurrence Table (Table 1) lists all threatened and endangered species and a determination of the probability of occurrence in the Ordnance Removal Project area. The natural history and distribution of each threatened and endangered species are discussed followed by an evaluation of the effects of the Proposed Action and Alternatives.

Gray Wolf (*Canis lupus*)

This large free-roaming canid once occupied nearly all habitats of the Northern Hemisphere. Today it occurs mainly in the arctic tundra and coniferous forests. The last wolf in West Virginia was killed in 1900, and it is now considered to be extirpated in the state. All populations of the gray wolf residing in the continental United States are designated as "endangered," except those living in Minnesota, which are listed as "threatened." The gray wolf is a social animal which lives in a pack. Its range depends on available prey, number of wolves, and season. It mates from February to March and the young are born between April and early June.

Effects: Since the gray wolf no longer occurs in West Virginia, no direct, indirect, or cumulative effects are anticipated from the Proposed Action or Alternative 2. The size of this project area is large enough to support the gray wolf in the event of a future reintroduction program. However, there are no plans for reintroduction of the gray wolf into West Virginia (C. Stihler in J. Wargo 1995).

Eastern Cougar (*Felis concolor couguar*)

The eastern cougar was once one of the most widespread mammals of the Western Hemisphere. It is now restricted to the mountainous, remote areas of the western United States and southwest Canada. Potential habitat for cougars is large, remote areas. The entire state of West Virginia was included in its historical range, but it is considered unlikely to be present in the state. If it were present, it would be found in remote, mountainous areas of hardwood or mixed forests. However, there is no physical evidence of occurrence of the eastern cougar in West Virginia. There have been some recent, unconfirmed sightings of this species in the state. Such sightings are probably the result of released captives (Vertebrate Species of Concern of West Virginia n.d.). The cougar is the largest North American cat, attaining a length of 60 to 110 inches and weighing 80 to 230 pounds. Its breeding season occurs in August and September, with young born in March or early April. The eastern cougar is listed as endangered by the United States Fish and Wildlife Service, and as an extirpated species in West Virginia by the United States Forest Service Regional Forester.

Effects: Although this project area is large enough to support the cougar, the Proposed Action or Alternative 2 are very limited in area and would not create an irretrievable loss of potential habitat.

Virginia Big-Eared Bat (*Plecotus townsendii virginianus*)

The Virginia big-eared bat is a true cave bat, with the females forming nursery colonies in caves during the summer and hibernating in tight clusters in the winter. They appear to be a relatively sedentary species, with no long distance migrations. The big-eared bat is fast and maneuverable, feeding on moths in forests and adjoining fields. The current known range of this bat in West Virginia includes Preston, Tucker, Grant, Hardy, Pendleton, and Randolph counties. The Virginia big-eared bat is federally listed as endangered. This species breeds both in the Monongahela National Forest and elsewhere in the state of West Virginia.

Effects: There are no records of occurrence or suitable potential habitat of the Virginia big-eared bat in the project area. As a result, direct, indirect, or cumulative effects are not anticipated on the Virginia big-eared bat from the Proposed Action or Alternative 2.

Indiana Bat (*Myotis sodalis*)

The Indiana bat is a cave dweller which can be found during the winter months hibernating in groups near cave entrances. Ideal hibernation temperatures range from 3° to 6°C with humidity at 66% to 95%. Declining numbers of this species have been attributed to several causes including disturbance of their hibernacula. Disturbances during this period can result in depletion of necessary energy reserves. During the summer, these bats gather in small colonies under loose bark on dead trees. Zones within 100 feet on either side of wide waterways (approximately 30 feet) are considered to be foraging habitat. In West Virginia, it has been reported in eight counties in the eastern highlands. One cave in Pendleton County accounts for 90% of the known individuals in the state. Its summer range is unknown. The Indiana bat is federally listed as endangered. This species breeds both in the Monongahela National Forest and elsewhere in the state of West Virginia.

Effects: There are no records of occurrence or suitable potential habitat of the Indiana bat in the project area, therefore, no direct, indirect, or cumulative effects are anticipated on the Indiana bat from the Proposed Action or Alternative 2.

Biological Evaluation

Virginia Northern Flying Squirrel (*Glaucomys sabrinus fuscus*)

The northern flying squirrel is a boreal forest species which occurs from Alaska and Canada to New England and south to North Carolina and Tennessee. The Virginia northern flying squirrel occurs only in West Virginia and Virginia. In the state, it is found in Pendleton, Pocahontas, Tucker, Webster, Greenbrier, and Randolph counties. It is associated with remnant stands of red spruce, balsam fir, hemlock, and northern hardwoods. It appears to favor mixed northern hardwood and red spruce forests above 940 meters. Its diet consists of fungi, lichens, and staminate cones, with nuts, fruits, and seeds making up a lesser part of its diet. The Virginia northern flying squirrel is active year-round and does not hibernate or undergo torpidity. It is active primarily during the evening hours, but may emerge for short periods during the day. It can have up to two litters of young each year, with young being born in late March and again in late August. Young often stay with the mother during the winter months and are included in the wintering aggregation which is common to flying squirrels. The major threats to the Virginia northern flying squirrels are the destruction of red spruce and mature northern hardwood forests and the expansion of the more aggressive southern flying squirrel. The Virginia northern flying squirrel is federally listed as endangered. This species breeds both in the Monongahela National Forest and elsewhere in the state of West Virginia.

Effects: There is one known population of the Virginia northern flying squirrel in the project area. This population is near the northwest corner of the Dolly Sods Wilderness. Other sites within the project area could have suitable habitat (i.e., large red spruce trees) for the Virginia northern flying squirrel. In all potential habitat where ordnance must be detonated, unexploded ordnance (UXO) crews should use noise-deadening techniques (i.e., sandbags). This should reduce the disturbances to the Virginia northern flying squirrel and reduce the possibility of shrapnel damaging trees and, as a result, no cumulative effects are anticipated from the Proposed Action or Alternative 2. To avoid disturbing the Virginia northern flying squirrel, April and May have been suggested as the best times to detonate ordnance (E. D. Michael personal communication).

Peregrine Falcon (*Falco peregrinus*)

The original range of the peregrine falcon was extensive and covered most of the northern hemisphere, including Canada and the United States. The number of birds is thought to be small; it has been estimated that there were only about 350 pairs in the eastern United States. Due to human disturbances and pesticide use, the species declined and was eventually extirpated in the eastern part of its range in the United States. Nesting sites in West Virginia have been located in Grant, Greenbrier, Hampshire, Mineral, Morgan, Pendleton, and Wyoming counties. In the state, all nesting sites were located on cliffs east of the Allegheny Mountains. Peregrine falcons also nest on bridges and buildings. The species now breeds in the east only in areas where it has been reintroduced. A hacking program managed by the West Virginia Division of Natural

Resources released 24 falcons at three sites on North Fork Mountain in Grant and Pendleton counties in 1988 and 1989 (Bucklew and Hall, 1994). North Fork Mountain is approximately five air miles east of the project area. A productive nest has been located in Grant County as a result of the hacking program. Peregrine falcons are now seen occasionally during the fall and winter in widespread areas of the state. It is listed as an endangered species by the United States Fish and Wildlife Service and as a B1d species by the Region 9 Regional Forester.

Effects: Peregrine falcons have not been observed in the project area, but the Red Creek canyon does have potential habitat (C. Stihler personal communication). Detonation of ordnance in the area of a nest could have a negative impact on nesting birds. Before detonation, all sites must be examined for nests by a qualified biologist. If nests are not present, no direct, indirect, or cumulative effects are anticipated in the Proposed Action or Alternative 2.

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle has been reported in the state in every month except January. Many sightings have occurred during fall migration at hawk-watching stations. They are also frequently seen over major rivers such as the Ohio, Kanawha, Cheat, and Monongahela. A pair has nested since 1981 in Hardy County, producing two to three young each year. In addition, a productive nest has been reported in Grant County (Hall, 1988). The bald eagle is currently listed as a threatened species by the United States Fish and Wildlife Service. This species breeds both in the Monongahela National Forest and elsewhere in the state of West Virginia.

Effects: There are no historical records of nest sites in the Dolly Sods Wilderness Area. Bald eagles are rare in West Virginia with most sightings reported during migration. Possible migration over the project area could occur. However, there are no large bodies of water in the project area which would provide suitable feeding and nesting sites. No direct, indirect, or cumulative effects would be expected on the bald eagle from the Proposed Action or Alternative 2.

Cheat Mountain Salamander (*Plethodon nettingi*)

The Cheat Mountain salamander is a small woodland species that inhabits high elevations of West Virginia. It is nocturnal but during the day can be found in the interior of decayed red spruce logs or under rocks and fallen limbs. The habitat of the Cheat Mountain salamander typically consists of high-elevation areas with some red spruce, scattered ground rocks, emergent rocks, rock outcrops, or ravines with *Rhododendron*. Eggs have been observed from May to August, usually with the female in attendance. The total range extends from Blackwater River canyon in the northeast to Dolly Sods, south to Spruce Knob, west to Thorny Flat, and north through Barton Knob to Blackwater River Canyon. This encompasses a five-county area in West

Virginia including Pendleton, Randolph, Pocahontas, Tucker, and Grant counties. The Cheat Mountain salamander is listed as a threatened species by the United States Fish and Wildlife Service. It is listed as a 2d species in the Monongahela National Forest by the Regional Forester.

Effects: There are two known populations of Cheat Mountain salamanders in the Dolly Sods Wilderness. Both of these populations are bisected by hiking trails, Fisher Spring Trail (#510) and Rohrbaugh Plains Trail (#508). However, most of the project area is considered high potential for Cheat Mountain salamanders. If ordnance must be removed or detonated, digging holes, and detonation of ordnance could directly affect the Cheat Mountain salamander. However, specific procedures have been designed to minimize potential impact on the Cheat Mountain salamander. Unexploded ordnance (UXO) crews will be responsible for all excavations. They will carefully remove all litter, soil, and vertebrates. Litter and soil will be placed in separate containers, and each vertebrate species will be put in a clean separate jar. After excavation is completed, soil, litter, and vertebrates will be returned to the precise location from where they were removed. A biologist will instruct the UXO crews regarding proper removal and return of vertebrate species. If ordnance is found, a biologist will assess the site for potential Cheat Mountain salamander habitat. If the site is considered to be potential habitat for the Cheat Mountain salamander, a biologist will conduct surveys for Cheat Mountain salamanders. In order to maintain the integrity of the habitat and increase the chances of locating Cheat Mountain salamanders, surveys will be conducted at night and within 48 hours of a rainfall. Area to be surveyed will include the estimated size of the crater plus 40 feet in all directions. If a Cheat Mountain salamander is located, each specimen will be placed in a separate jar, maintained in a cool environment (approximately 15°C), and returned to the precise location after the area has been restored (no longer than 24 hours). In restoring the site, the litter and soil from the site will be returned to the crater. Logs and flat stones (logs and stones are diurnal cover objects) from the immediate area will be placed over the soil. If additional soil and litter are required to fill the crater, both will be obtained within 100 feet of the site. It is imperative that soil and litter not be transported from outside the immediate area. To minimize the effects of the transfer of litter and soil, small quantities of litter and soil will be removed from several areas within the designated area. Foreign litter and soil could contain juvenile redback salamanders (*Plethodon cinereus*) and/or mountain dusky salamanders (*Desmognathus ochrophaeus*) which are known competitors with the Cheat Mountain salamander (Pauley, 1980). Soil and litter will be carefully examined for all salamander species (adults and juveniles) including the Cheat Mountain salamander. No species of salamander will be moved from its territory. While it is possible that there may be some incidental taking of Cheat Mountain salamanders, the impact to a population should be minimal. If these procedures are followed, no cumulative effects on the viability of a Cheat Mountain salamander population are anticipated from the Proposed Action or Alternative 2. Foot travel and cutting of vegetation should be held to a minimum in all potential habitat areas.

Findings and Effects—Sensitive Species

The Appalachian cottontail is the only confirmed occurrence of sensitive species known within the project area. Species that could possibly occur include the green salamander, southern rock vole, southern water shrew, Allegheny woodrat, and the northern goshawk.

The Likelihood of Occurrence Table (Table 1) lists all sensitive species and the probability of occurrence in the Ordnance Removal Project area. The natural history, distribution, and evaluation of the effects of the Proposed Action and Alternatives 1 and 2 on each sensitive species are discussed.

Aquatic/Riparian Habitat

There are several wetlands in the project area, predominantly bogs and first-order streams. Large wetlands are located in the Fisher Spring Run area, Stone Coal Run area, and south of Breathed Mountain Trail (#553). Streams include Fisher Spring Run, Stonecoal Run, Little Stonecoal Run, and Red Creek.

Southern Water Shrew (*Sorex palustris punctulatus*)

The southern water shrew is semiaquatic and lives along mountain streams and bogs associated with deciduous, coniferous, and mixed deciduous-coniferous forests. It is frequently found in cool, moist, moss-covered rock outcrops, crevices, fallen trees, boulder-strewn areas, and in overhanging stream banks. It is active year-round, day and night, with peak activity at dawn and dusk. The breeding season is from late March to August or September, with a gestation period of about 21 days. The diet of the water shrew consists mainly of small aquatic animals, such as small fish, worms, caddis fly nymphs, stoneflies, and mayflies. Terrestrial invertebrates are also taken. Protection of habitat, especially water quality, has been identified as the primary management technique.

Effects: Indirect impacts from the Proposed Action or Alternative 2 could result in possible sedimentation occurring along streams. Ordnance in a stream or close enough to cause a sedimentation problem should be removed and detonated away from the stream. There are no records of the southern water shrew in the project area, but suitable habitat could occur in several locations. The West Virginia Division of Natural Resources (n.d.) has the water shrew listed as an "undetermined" species. This species breeds both in the Monongahela National Forest and elsewhere in the state of West Virginia.

Cheat Minnow (*Rhinichthys bowersi*)

The Cheat minnow is found in the Monongahela River drainage of Pennsylvania, West Virginia, and Maryland. Within West Virginia, it has been taken from the Cheat River drainage, Tygart Valley River, and minor tributaries of the Monongahela River. Its preferred habitat is small runs and riffles of small streams to medium rivers, with small to large rubble substrates. A large portion of the range of this species lies within the Monongahela National Forest. There are no known occurrences in the project area.

Effects: If streams are not impacted, there should be no direct, indirect, or cumulative effects on the Cheat minnow as a result of the Proposed Action or Alternative 2. It is a candidate for federal listing, but lacks substantial data. The West Virginia Division of Natural Resources (n.d.) has the Cheat minnow listed as an "undetermined" species. This species breeds both in the Monongahela National Forest and elsewhere in the state of West Virginia.

Rock Outcrop, Talus Slope, or Rock Woods Habitats

Talus and rock woods habitats are common throughout the Dolly Sods Wilderness.

Green Salamander (*Aneides aeneus*)

The green salamander is found in the Allegheny and Cumberland Mountains from Pennsylvania to Alabama and in the Blue Ridge Mountains in North and South Carolina and Georgia. Approximately one-third of its total range occurs in West Virginia. Over-collecting and loss of habitat have drastically reduced population levels in some parts of its range. The green salamander is found in narrow cracks and crevices in emergent rocks and rock outcrops which are moist (not wet) and protected from the sun. Egg deposition occurs in May or early June. It has been found over 3,000 feet in Tucker County along the rim of the Blackwater Canyon (Pauley, 1993). There are no known populations of this species in the project area. Any emergent rocks or rock outcrops should be examined by a qualified biologist before detonation activities.

Effects: Due to the limited area to be impacted by the ordnance removal, there should be no direct, indirect, or cumulative effect to this species from the Proposed Action or Alternative 2. The green salamander is a candidate for federal listing but substantial data are needed. The West Virginia Division of Natural Resources (n.d.) has the green salamander listed as a species of "special concern". It is listed as a 2d species in the Monongahela National Forest by the Region 9 Regional Forester.

Biological Evaluation

Eastern Small-Footed Bat (*Myotis subulatus leibii*)

There are three subspecies of small-footed bats, two in the western half of the United States and one in the eastern half. The eastern subspecies, *Myotis subulatus leibii*, has been reported in nine counties in West Virginia, including Preston, Tucker, Randolph, Pendleton, Pocahontas, Greenbrier, Monongalia, Grant, and Monroe counties. The bat hibernates in caves, but during the summer it may be found in old buildings, rock crevices, or under rock slabs.

Effects: There are no known caves or populations of this species in the project area, and there should be no direct, indirect, or cumulative effects to this species from the Proposed Action or Alternative 2. It is federally classified as a candidate for listing but lacks substantial data. The West Virginia Division of Natural Resources (n.d.) has the eastern small-footed bat listed as a species of "special concern". This species breeds both in the Monongahela National Forest and elsewhere in the state of West Virginia.

Allegheny Woodrat (*Neotoma floridana magister*)

The Allegheny woodrat is the only member of the genus *Neotoma* living in the eastern United States. Its habitat includes extensive rocky areas, caves, crevices, cliffs, and river banks with sandstone rocks and boulders. It is found throughout most of West Virginia. It is opportunistic and may build nests in abandoned buildings. The woodrat is primarily a vegetarian, with a diet consisting of berries, leaves of herbaceous plants, and nuts. It will also take insects. In the fall, the woodrat collects leafy twigs, branches of trees or shrubs, and puffballs or other mushrooms. The woodrat is nocturnal and remains active throughout the year. It does not hibernate or undergo torpidity. Biologists are concerned about the recent decline in woodrat populations. Proposed explanations for the decline include human disturbance of nests in caves, loss of acorn supply due to gypsy moth defoliation, parasitism by a roundworm, and abnormally severe winters.

Effects: Because of the limited area of disturbance, there should be no direct, indirect, or cumulative effects to this species from the Proposed Action or Alternative 2. However, potential habitat should be checked by a qualified biologist before detonation activities. The Allegheny woodrat is a candidate for federal listing, but lacks substantial data. This species breeds both in the Monongahela National Forest and elsewhere in the state of West Virginia. The Allegheny woodrat is not listed by the West Virginia Division of Natural Resources (n.d.).

Mixed Hardwood/Coniferous Forest Habitat

The project area contains stands of hardwoods, conifers, and mixed hardwoods and conifers. Most trees are small due to the severe weather conditions, low fertility of the soil, short growing season, past logging activities, and past wildfires.

Northern Goshawk (*Accipiter gentilis*)

The goshawk is found primarily in Canada and Alaska. Its range extends to New Mexico and Arizona in the western part of the United States. In the east, it extends southward along the Appalachian Mountains into West Virginia. There are occasional sightings of goshawks, mostly in the winter. The only confirmed nesting sites in West Virginia are in Tucker, Pocahontas, and Randolph counties. A nest with young has been reported near Davis in Tucker County (Buckelew, 1991). Goshawks require remote, heavily forested areas, particularly coniferous forest. Nests are placed on a limb against the trunk of a tree. Suitable nesting habitat is available in West Virginia, but it is limited. No populations are known in the project area.

Effects: If trees are not cut, the only potential effect would be the detonation of the ordnance. The area should be examined to assure that a nest is not in the vicinity of a potential blast. If nests are not located, no direct, indirect, or cumulative effects are anticipated from the Proposed Action or Alternative 2. The goshawk is a candidate for federal listing, but requires more substantial data. This species breeds both in the Monongahela National Forest and elsewhere in the state of West Virginia. The West Virginia Division of Natural Resources (n.d.) has the northern goshawk listed as a species of "scientific interest".

Cerulean Warbler (*Dendroica cerulea*)

The cerulean warbler is the most numerous breeding warbler in the southern hardwood forest and the oak-hickory forest along the Ohio, Monongahela, and Kanawha rivers. Although common throughout the Western Hills Region, it is less common and local in the Allegheny Mountains. East of the mountains it is found in a few isolated places. Prime breeding habitat for the cerulean warbler is described as mature deciduous forest, particularly in floodplains or other mesic conditions. Breeding habitats are unlikely to occur in the project area. There are no nesting records for this species in the project area.

Effects: There should be no direct, indirect, or cumulative effect to this species from the Proposed Action or Alternative 2. The cerulean warbler is a candidate for federal listing, but lacks substantial data. This species breeds both in the Monongahela National Forest and elsewhere in the state of West Virginia. The cerulean warbler is not listed by the West Virginia Division of Natural Resources (n.d.).

Southern Rock Vole (*Microtus chrotorrhinus cardinensis*)

This high elevation species is associated with rocky, boulder-strewn areas in coniferous, deciduous and mixed deciduous-coniferous forests. Little is known about its food habits, but it is known to exhibit a high water requirement. This species is active year-round and does not hibernate or undergo torpidity. It is diurnal with most activity occurring during the morning hours. It breeds from early spring to late autumn, with a gestation period of about 20 days. In West Virginia, the southern rock vole has been reported from Greenbrier, Pendleton, Pocahontas, Randolph, and Tucker counties. The habitat consists of small, isolated areas and the species is vulnerable to localized extinction with an unlikely chance of repopulation through immigration.

Effects: There are no known populations of this species in this area, and as a result, no direct, indirect, or cumulative effects are anticipated to this species from the Proposed Action or Alternative 2. Any potential habitat should be examined by a qualified biologist. It is a candidate for federal listing, but lacks substantial data. This species breeds both in the Monongahela National Forest and elsewhere in the state of West Virginia. The West Virginia Division of Natural Resources (n.d.) has the rock vole listed as a species of "scientific interest".

Appalachian Cottontail (*Sylvilagus obscurus*)

The habitat of the Appalachian cottontail consists of cool woods with dense, shrubby understory. It is found in areas which include mixed yellow birch-red maple with red spruce, hemlock, *Rhododendron*, or mountain laurel. It also occurs in 6-7-year-old clearcuts and overgrown farmsteads. The Appalachian cottontail has recently been identified as a new species separate from the New England cottontail. It is better adapted to cold temperatures and dense forests than the New England cottontail. The Appalachian cottontail is found throughout the project area.

Effects: Because of its mobility and the small size of area to be disturbed, there should be no direct, indirect, or cumulative effect to this species from the Proposed Action or Alternative 2. The Appalachian cottontail is listed as a candidate for federal listing, but lacks substantial data. This species breeds both in the Monongahela National Forest and elsewhere in the state of West Virginia. The Appalachian Cottontail is not listed by the West Virginia Division of Natural Resources (n.d.).

Biological Evaluation

Summary

Based on data presented in this Biological Evaluation, it is concluded that only two listed species, the Cheat Mountain salamander and the Virginia northern flying squirrel, could be directly affected from implementing the Proposed Action or Alternative 2 in the Ordnance Removal Project in the Dolly Sods Wilderness. If the mitigation measures developed to protect the Cheat Mountain salamander are followed, no adverse effects are anticipated on this species. The Virginia northern flying squirrel would only be affected if trees are removed. If trees are not removed, the Proposed Action or Alternative 2 should not directly affect the Virginia northern flying squirrel. It is not anticipated that the proposed project will cause loss of viability of populations of any other endangered, threatened, or sensitive species.

If any endangered, threatened, or sensitive species are observed during the implementation of this project, consultation among all appropriate parties (including the U.S. Forest Service and the U.S. Fish and Wildlife Service) should be initiated.

Prepared by: Thomas K. Pauley (NHV) July 7, 1995

Thomas K. Pauley, Ph.D. (NHV) Date

Deborah Wegmann (NHV)

Deborah Wegmann, B.S. (NHV)

Biological Evaluation

Explanation of Status

E = Federal listing as Endangered
T = Federal listing as Threatened

C2 = Candidate for Federal listing; information on hand indicates that proposing to list is possibly appropriate, but conclusive data are not currently available to support it.

G = Natural Heritage Program Global Rank

G1 = Less than 6 occurrences globally; critically imperiled; especially vulnerable to extinction.

G2 = 6-20 occurrences globally; imperiled and very vulnerable to extinction throughout its range.

G3 = 21-100 occurrences globally; either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g. in a single state or physiographic region) or because other factors make it vulnerable to extinction throughout its range.

G4 = Apparently secure globally.

G5 = Demonstrably secure globally.

S = Natural Heritage Program State Rank

S1 = Critically imperiled in state. Five or fewer occurrences.

S2 = Imperiled in state. 6-20 occurrences.

S3 = Rare or uncommon in state. 21-50 occurrences.

SH = Historical occurrence in state.

\- = Status not determined.

T_ = Status of subspecies or variety.

Q = Status questionable.

West Virginia Division of Natural Resources Ranking

Special Concern = A species which was once more common or widespread in West Virginia and is now thought to be declining, becoming more restricted in range or possibly extirpated.

Scientific Interest = A species which has a unique scientific value or has probably always been uncommon in West Virginia because the state is on the periphery of its range.

Undetermined Species = Species believed to be uncommon in West Virginia, but supportive data are lacking.

USDA — Forest Service Eastern Region Sensitive Species List

1 = Restricted to the Forest within the state.

2 = Found within the Forest and other areas within the state.

3 = Documented extant occurrence within the Forest.

4 = Breeding population.

EX = Previously present but now extirpated from the Forest.

Table 1
Endangered, Threatened, and Sensitive Species Likelihood of Occurrence

Endangered/Threatened Species Name/Status/Habitat	Likelihood of Occurrence
Mammals	
Gray Wolf (*Canis lupus*) E/SH High spruce forests and associated northern mixed hardwood/coniferous forest. The last wolf in the state was killed in 1900.	Unlikely; extirpated from WV
Virginia Big-eared Bat (*Plecotus townsendii*) E/G5T2/S2 In winter, hibernates in selected suitable caves. In summer, roosts in selected caves. Found in Preston, Grant, Tucker, Hardy, Pendleton, and Randolph counties.	Unlikely; no suitable habitat in project area.
Eastern Cougar (*Felis concolor couguar*) E/G4TH/SH Expansive, isolated mountainous areas; hardwood or mixed forests.	Unlikely; extirpated from WV.
Indiana Bat (*Myotis sodalis*) E/G2/S1 In winter, hibernates in selected caves. Known from Preston, Tucker, Pendleton, Randolph, Pocahontas, Hardy, Monroe, and Greenbrier counties.	Unlikely; no suitable habitat in project area.
Virginia Northern Flying Squirrel (*Glaucomys sabrinus*) E/G5T2/S2 Coniferous, mixed deciduous/coniferous northern hardwood forests with some 10"+ DBH trees and partial canopy closure. Lowest recorded elevation is 2,860'. Known from Randolph, Greenbrier, Webster, Tucker, Pocahontas, and Pendleton counties.	Probable; known population in project area, suitable habitat may occur in project area.
Birds	
Peregrine Falcon (*Falco peregrinus anatum*) E/G3/S1 Nest sites located on cliffs, ground, buildings, and bridges. Isolation from human disturbance. Historic nest sites in Grant, Pendleton, Hampshire, Mineral, Morgan, Wyoming, and Greenbrier counties. Recent nest site in Grant County.	Possible; suitable habitat may be present in the Red Creek Canyon.

Table 1
Endangered, Threatened, and Sensitive Species Likelihood of Occurrence (Continued)

Name/Status/Habitat	Likelihood of Occurrence
Endangered/Threatened Species	
Birds (Continued)	
Bald Eagle (*Haliaeetus leucocephalus*) T/G3/S1	
Nests in tall trees or on cliffs near large rivers or lakes. Known nesting sites in Hardy and Grant counties.	Unlikely; no suitable habitat.
Amphibians	
Cheat Mountain Salamander (*Plethodon nettingi*) T/G2/S2	
Moist spruce/deciduous forests, including but not limited to shaded or moist coves, possibly with rhododendron and/or small emergent rocks within a spruce or hemlock forest. Spruce stands containing *Bazzania* (a liverwort). Minimum elevation 2,600'. Boundary of range: North at Blackwater Canyon, extending east to Dolly Sods, south to Spruce Knob, west to Thorny Flat, north through Barton Knob to Blackwater Canyon. Known to occur in Grant, Pendleton, Randolph, Tucker, and Pocahontas counties.	Probable; known populations and suitable habitat in project area.
Sensitive Species	
Mammals	
Southern Rock Vole (*Microtus chrotorrhinus carolinensis*) C2/G5T3/S3	
Moist talus or among mossy rocks and logs in spruce and northern hardwood forests, often birch, hemlock and other hardwoods. Ground cover of mosses, ferns, and northern herbs. Unvegetated talus, grass balds, recent clearcuts, and roadfills. Favors moist situations and higher elevations. Highly associated with permanent water. Found in Tucker, Randolph, Pendleton, Pocahontas, and Greenbrier counties.	Possible; suitable habitat available, but species is not known from the project area.
Eastern Small-footed Bat (*Myotis leibii*) C2/G3/S2S3	
Old buildings, rock crevices, rock slabs, stones and caves. Found in Preston, Tucker, Randolph, Grant, Pendleton, Pocahontas, Greenbrier, Monongalia, and Monroe counties.	Possible; suitable habitat available, but species is not known from the project area.

Table 1
Endangered, Threatened, and Sensitive Species Likelihood of Occurrence
(Continued)

Sensitive Species Name/Status/Habitat	Likelihood of Occurrence
Mammals (Continued)	
Allegheny Woodrat (*Neotoma magister*) C2/G5T4Q Extensive rocky areas, outcrops, cliffs, talus slopes with boulders, crevices and caves. Also, river banks with sandstone rocks and boulders. Occurs nearly statewide.	Probable; suitable habitat available, but species is not known from the project area.
Appalachian/Southern Water Shrew (*Sorex palustris punctulatus*) C2/G4/S3 In or near swiftly-flowing rocky streams. In or near northern hardwood forests, dominant trees being yellow birch and red maple, with dense rhododendron understory. Found in Preston, Tucker, Randolph, Pendleton, and Pocahontas counties.	Possible; suitable habitat available, but species is not known from the project area.
Appalachian Cottontail (*Sylvilagus obscurus*) C2/G4/S3 Cool, high elevation woods with dense, shrubby understory. Also 6-7-year-old clearcuts and overgrown farmsteads. Mixed yellow birch-red maple, with glades of red spruce, rhododendron small irregular shrubby openings. Areas of hemlock and rhododendron in oak-hickory forests. Probably occurs in most higher elevations.	Probable; suitable habitat in project area.
Birds	
Northern Goshawk (*Accipiter gentilis*) C2/G4 Coniferous, deciduous and mixed forests. Utilizes a variety of forest types, structural conditions and successional stages. Recorded in Randolph, Tucker, and Pocahontas counties.	Possible; suitable habitat may be available. Species is not known from project area.
Cerulean Warbler (*Dendroica cerulea*) C2/G4 Mature deciduous forest, particularly in floodplains or other mesic conditions. Common through western hills of West Virginia, but becomes uncommon and local toward the Alleghenies. Greatest numbers found below 1,980'.	Unlikely; no suitable habitat in project area.

Table 1
Endangered, Threatened, and Sensitive Species Likelihood of Occurrence
(Continued)

Sensitive Species Name/Status/Habitat	Likelihood of Occurrence
Amphibians	
Green Salamander (*Aenides aeneus*) C2/G4/S3 Found in rock crevices in rock faces, well-shaded and moist, under bark on trees, and in rotting logs. Deciduous or deciduous/coniferous or rocky habitats.	Possible; suitable habitat may be available, but species is not known from the project area.
Hellbender (*Cryptobranchus alleganiensis*) C2/G4 Found in larger permanent streams that are cool and clear. Remains in calm pools during the day and moves to the rapids at night to feed.	Unlikely; no suitable habitat in project area.
Fish	
Candy Darter (*Etheostoma osburni*) C2/G3/S1 Rocky riffles of small streams to medium-sized rivers with cool to cold temperatures. Gauley and New River drainages.	Unlikely; outside of known range.
Kanawha Minnow (*Phenecobius teretulus*) C2/G3/S1 Riffles and runs of medium to large streams with gravel, rubble or boulder substrate. Upper Gauley River and New River tributaries.	Unlikely; outside of known range.
Cheat Minnow (*Rhinichthys bowseri*) C2/G1/S2 Small to large rubble substrates, small runs and riffles of small streams to medium rivers. From drainages of the Cheat, Tygart Valley, Monongahela and Youghiogheny Rivers. Possibly the upper Greenbrier River.	Possible; suitable habitat may be available, but species is not known from the project area.
Invertebrate species	
Cheat Valley Cave Isopod (*Caecidotea cannulus*) C2/G2/S1 Found under flat rocks in subterranean streams and pools in caves. Only known to occur in southern Tucker and Randolph counties.	Unlikely; no suitable habitat in project area.

Table 1
Endangered, Threatened, and Sensitive Species Likelihood of Occurrence
(Continued)

Sensitive Species Name/Status/Habitat	Likelihood of Occurrence
Invertebrate Species (Continued)	
Holsinger's/Greenbrier Valley Cave Isopod (*Caecidotea holsingeri*) G3/S3 The most common and widespread troglobitic isopod in West Virginia. In cave stream gravel, under rocks, on decaying wood in streams and occasionally in drip pools.	Unlikely; no suitable habitat in project area.
Organ Cave Snail (*Fontigens tartarea*) G3/S3 Found under flat rocks in streams with moderate current. Only known from selected caves in Greenbrier, Tucker, Randolph, and Pocahontas counties.	Unlikely; no suitable habitat in project area.
Green Floater (*Lasmigona subviridis*) C2/G3/S1 Fine gravel and sand in backwater and slower water. Patchy occurrence in small to large rivers away from fast current and large boulders. Currently in Greenbrier River and Clover Creek. Past record from the New River drainage. Any Greenbrier River tributary is potential habitat. Two sites on the west fork of the Greenbrier above Durbin. Potentially from Cass south on the Greenbrier. Possible at Deer Creek.	Unlikely; outside of known range.
Elktoe (*Alasmidonta marginata*) C2 Sandy gravel and cobble substrate in good currents; not found in muddy water. Only known from the Greenbrier River, Cloverlick down through Hosterman, possible up to Durbin and the lower West Fork located south of Little River.	Unlikely; outside of known range.
A Spider (*Phaneta subterranea*) G3/S3 A common troglobite in caves throughout most of the eastern United States. Usually near damp, decaying organic debris. In West Virginia, known from 27 caves in 9 counties.	Unlikely; no suitable habitat in project area.

Table 1
Endangered, Threatened, and Sensitive Species Likelihood of Occurrence (Continued)

Sensitive Species Name/Status/Habitat	Likelihood of Occurrence
Invertebrate Species (Continued)	
Dry Fork Valley Cave Beetle (*Pseudanophthalmus montanus*) C2/G1/S1 Occurs in twilight zone or deeper in selected caves. Also in or on moist soil, often near streams or drip areas, often under rocks or debris. Only known from 4 West Virginia caves in Tucker and Randolph counties.	Unlikely; no suitable habitat in project area.
West Virginia Blind Cave Millipede (*Trichopetalum krekeleri*) G1/S1 In selected caves, under rocks, around organic debris, or on damp silt banks near streams. Known from only 5 West Virginia caves.	Unlikely; no suitable habitat in project area.
Looper Moth (*Euchlaena milnei*) C2/GU/S? Found on dry ridges in eastern portion of the state, extending from north to south border of the state. Range ends where northern hardwoods start. Specimens have been taken in Smoke Hole region of Potomac Ranger District down through Reed's Creek.	Unlikely; no suitable habitat in project area.

REFERENCES

Buckelew, A. R., Jr. 1991. Recent northern goshawk breeding records from the West Virginia highlands. Redstart 58:74-75.

Buckelew, A. R., Jr. and G. A. Hall. 1994. The West Virginia Breeding Bird Atlas. Univ. Pittsburgh Press, Pa. 215 pp.

Canterbury, R. A. and T. K. Pauley. 1990. Gut analysis of the green salamander (*Aneides aeneus*) in West Virginia. Proc. W. Virginia Acad. Sci. 62(2, 3, 4):47-50.

Canterbury, R. A. and T. K. Pauley. 1994. Time of mating and egg deposition of West Virginia populations of the salamander *Aneides aeneus*. J. Herp. 28(4):431-434.

Chapman, J. A., K. L. Cramer, N. J. Dippenaar, and T. J. Robinson. 1992. Systematics and biogeography of the New England cottontail, *Sylvilagus transitionalis* (Bangs, 1895), with the description of a new species from the Appalachian Mountains. Proc. Biol. Soc. Wash. 105(4):841-866.

Chipps, S. R., W. Perry, and S. Perry. 1993. Status and distribution of *Phenacobius teretulus*, *Etheostoma osburni*, and "*Rhinichthyes bowersi*" in Monongahela National Forest in West Virginia. Va. J. Sci. 44(1)47-57.

Clark, M. K. and D. S. Lee. 1987. Big-eared bat, *Plecotus townsendii* in western North Carolina. Brimleyana. 13:137-140.

Clayton, J. WVDNR. Personal communication. Re: Mussels in the Dolly Sods Wilderness.

Culver, D. C. and T. J. Ehlinger. 1980. Effects of microhabitat size and competition size in two cave isopods. Brimleyana. 4:103-113.

Dalton, V. M. 1987. Distribution abundance and status of bats hibernating in caves in Virginia. Va. J. Sci. 38(4)369-379.

Finnley, D. (ed.). 1979. Critical habitat proposed for the Virginia big-eared bat. Endangered Species Technical Bulletin 4(9)1979:4,6.

Fox, T. BBC. Personal communication. Re: Birds in the Dolly Sods Wilderness.

Garten, E. R., F. Grady, and S. D. Carey. 1993. The Vertebrate Fauna of West Virginia Caves. WV Speleological Survey, Bulletin 11. 107 pp.

Graffious, L. BBC. Personal communication. Re: Birds in the Dolly Sods Wilderness.

References (Continued)

Green, N. B. and T. K. Pauley. 1987. Amphibians and Reptiles in West Virginia. Univ. Pittsburgh Press, Pa. 241 pp.

Grub, T. G., W. W. Bowerman, J. P. Giesy, and G. A. Dawson. 1992. Responses of breeding bald eagles *Haliaeetus leucocephalis* to human activities in northcentral Michigan. Can. Field. Nat. 106(4)443-453.

Hall, G. A. 1983. West Virginia Birds. Carnegie Museum of Natural History, Special Publication No. 7. 180 pp.

Hall, G. A. 1988. The Appalachian Region. *American Birds*. 42:1286-89.

Hall, G. A. 1993. Birds of the Upland Forest. IN: Upland Forests in West Virginia, S. L. Stephenson ed. 197-210.

Hamel, P. B. 1992. Cerulean Warbler. Migratory Nongame Birds of Management in the Northeast. U.S. Dept. of Interior, F&W Service. 400 pp.

Harvey, M. J. 1991. Distribution and status of Chiroptera in Kentucky and Tennessee. J. Tenn. Acad. Sci. 66(4):191-194.

Hight, M. E. 1990. Endangered bats in West Virginia. IN: Endangered and Threatened Species. Redstart, Special Publication: 29-35.

Holsinger, J., R. Baroody, and D. Culver. 1976. The Invertebrate Cave Fauna of West Virginia. W.Va. Speleological Society Survey Bulletin No. 7, 46 pp.

Kipley, R. C. 1995. Biological evaluation of the effects of projects in the proposed action and alternatives on endangered, threatened, and sensitive species in the Elk Mountain timber sale project area.

Merritt, J. E. 1987. Guide to Mammals of Pennsylvania. Univ. Pittsburgh Press, Pa. 408 pp.

Michael, E. D. W.Va. University. Personal communication. Re: Virginia northern flying squirrel.

Olsen, P. D. and J. Olsen. 1988. Breeding of the peregrine flacon (*Falco peregrinus*): weather, nest spacing, and territory occupancy. Emu 88(4):195-201.

Pauley, T. K. 1980. The ecological status of the Cheat Mountain salamander (*Plethodon nettingi*). Unpublished report to U.S. Forest Service. 160 pp.

References (Continued)

Pauley, T. K. 1993. Amphibians and Reptiles of the Upland Forest. IN: Upland Forests in West Virginia, S. L. Stephenson ed. 179-195.

Pauley, T. K. 1994. Known status of the eastern hellbender (*Cryptobranchus a. alleganiensis*) and the green salamander (*Aneides aeneus*) in the Monongahela National Forest.

Pauley, T. K. and R. C. Canterbury. 1990. Amphibians and reptiles of special concern in West Virginia. Redstart, Special Publication: 38-43.

Samples, B. E. and R. C. Whitmore. 1993. Food habits of the endangered Virginia big-eared bat in West Virginia. J. Mamm. 74(2):428-435.

Santiago, J. 1995. Biological evaluation of effects of projects on endangered, threatened, and sensitive species in the Beaverdam Ridge Project Area.

Sargent, B. WVDNR Natural Heritage. Personal communication. Re: Rare zoological species in West Virginia.

Sargent, B. WVDNR Natural Heritage. Personal communication. Re: Search of Natural Heritage database for endangered, threatened, and sensitive species occurrences in the project area.

Smith, R. L. 1993. Wildlife of the Upland Forest: IN: Upland Forests in West Virginia, S. L. Stephenson ed. 211-229.

Stihler, C. WVDNR. Personal communication. Re: Endangered, threatened, and sensitive species in West Virginia.

Tipton-Dalton, V. M., V. Brack, Jr., and P. M. McTeer. 1986. Food habits of the big-eared bat, *Plecotus townsendii virginianus*, in Virginia. Va. J. Sci. 37(4):248-254.

USDA Forest Service. 1994. Eastern Region Regional Forester's Sensitive Species List.

Wargo, J. G. 1995. Biological evaluation to the effects of remaining projects in the Red Oak North Opportunity Area on endangered, threatened, and sensitive species.

West Virginia Division of Natural Resources Nongame Program. n.d. Vertebrate Species of Concern in West Virginia. 105 pp.

APPENDIX V

Dolly Sods Wilderness Area Study: Draft Report

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West Virginia
University

DOLLY SODS WILDERNESS AREA STUDY: DRAFT REPORT

Division of
Forestry

Morgantown,
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Steven J. Hollenhorst

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November 2, 1991

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INTRODUCTION

The measurement of social and resource conditions in a wilderness provides managers with critical information for management decisions. This information includes attitudes towards wilderness, perceptions on the current conditions within the wilderness, and the status of resource conditions. Although essential for sound management decisions, there has been a serious lack of this type of information around the country. Often this is the result of insufficient funding and/or personnel, but it can also be attributed to the difficulty of measuring these conditions. This study is an important element of the Limits of Acceptable Change (LAC) process, which is being adopted in the Dolly Sods Wilderness. LAC provides a process by which managers can identify, measure, and evaluate social and resource conditions.

Through a cooperative arrangement between the Monongahela National Forest and the Division of Forestry at West Virginia University, a study was conducted during the summer of 1991 to gain more information on social and resource conditions in the Dolly Sods and Cranberry Wildernesses. Outlined here are the results of the work completed in the Dolly Sods.

OBJECTIVES

The purpose of this study was to provide managers of the Dolly Sods Wilderness with an in-depth analysis of the area's social and resource conditions. Specific objectives were to:

1. Identify indicators representative of the social and resource conditions in the Dolly Sods and the importance of these indicators to visitors.

2. Identify both the unacceptable and the preferred levels of these indicators to visitors of the Dolly Sods.

3. Identify the current status of the indicators through field measurements and as perceived by visitors.

STUDY PROCESS

Survey Instrument

A team of managers from the Monongahela National Forest and from the Division of Forestry at West Virginia University developed a questionnaire to measure the social conditions within the Dolly Sods. Team members identified in a March 1991 meeting indicators that were both meaningful to the management of the Dolly Sods and to the

visitor. Priority was placed on indicators that managers could at least partially influence. These indicators reflected many of the issues and concerns developed during the Opportunity Area Analysis (OA), currently being completed in the Dolly Sods. These issues and concerns include but are not limited to:

- The use of Laneville cabin for a ranger station
- Area development
- Horses in the Dolly Sods
- Dogs in the Dolly Sods
- Reintroducing native animals (inc. wolves)
- Grazing
- Hunting
- User fees
- Natural wildfires
- Military uses
- Monitoring/Controlling overflights
- Maintenance of existing solitude
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- Limits on users/control of overuse
- Re-establishment of permit system
- Group size limits
- Limit camping to designated sites
- Discourage campfires
- Boundary markings
- Interpretation outside of Wilderness
- Preservation of history of Sods
- Information about flora and fauna
- Trailhead information
- Deflect Wilderness use to other areas with information
- Plowing FR19 in winter
- Closing/opening FR80
- Additional trail construction
- Establish R.O.W. for Blackbird Knob
- Bridges on Red Creek Trail
- Trail maintenance in Wilderness
- Trail blazing
- Trail signs

Twelve indicators of wilderness conditions were identified (questionnaire item #10). Visitors were asked to rate, on a scale of one to five, how important these items were to their wilderness experience. Respondents were also asked to provide information on their perceptions of current conditions in the wilderness (questionnaire items #6 and #8), and their acceptable and preferred levels of these conditions (questionnaire item #12). Respondents were asked to rate, on a scale of one to five, twenty items on what

motivated them to visit a wilderness area (questionnaire item #9).

Respondents were asked to give various demographic information, such as current residence, length of stay, party size, what activities they participated in while in the Dolly Sods, and why they chose the Dolly Sods. Two open-ended questions were asked to allow respondents the opportunity to express opinions on their experience in the Dolly Sods. A map was placed at the end of the questionnaire for respondents to map where they had entered and exited the wilderness, as well as where they hiked and camped.

Questionnaires were distributed from May 18 to September 2, 1991. A business reply page was placed at the center of the questionnaire. When respondents finished filling out the questionnaire, they could fold the questionnaire over, staple it, and mail it back to us. Questionnaires were distributed by three methods: they were left on cars at trailheads, given directly to the visitor if met in the wilderness, or left at registration boxes.

Inventory of Resource Conditions

Campsite impacts were felt to be an important aspect of the quality of the wilderness experience in the Dolly Sods. A campsite inventory method was devised that allowed us to gather specific information on the following resource indicators: distance and screening from trails, water, and closest campsites; litter; human waste sites; shoreline disturbance; user built facilities (i.e. firerings, seats, etc.); tree damage; loss of vegetation; mineral soil exposure; root exposure; tree damage; and social trails.

Field data was collected from early May through August 1991. Field crews identified sites in which impacts had occurred through human use. A map of these sites was generated using a Geographic Information System (GIS). These sites were inventoried for each of the above indicators.

RESULTS

Of the approximately 318 surveys distributed, 92 were returned and usable, for a response rate of 28.9%. Most visitors surveyed were weekend users (71.7%), while only 7.6% were weekday users. Dates were not obtained for 20.6% of the surveys. No significant differences were found between the three groups. Data, therefore, was combined, except as noted. The actual study findings are presented in Appendix A. The open ended comments were compiled, edited for spelling, and are presented in Appendix C. A summary of the study findings is presented as follows.

Visitor Characteristics

Most visitors were from the Mid-Atlantic region. The majority of visitors were from Virginia (33%), followed by Maryland (22%), West Virginia (16.9%), and Pennsylvania (11%). Visitors indicated that they learned about Dolly Sods from friends or family (60%), or from literature (16.7%), such as hiking guides. Most visitors chose the Dolly Sods because of its beauty (20%), isolation (12.2%), and its location (12.2%).

A majority of visitors spent at least one night in the Dolly Sods (81.5%). The average length of stay for these users was 2.1 nights. Day users comprised 18.5% of visitors, and they averaged 6.5 hours in the area. The average number of people in a party was 3.9. Interestingly, 12% of respondents visited the Dolly Sods alone.

Respondents were asked to indicate which activities they participated in while in the Dolly Sods (Table 1) . The primary activities were hiking on trails (99% of visitors), camping (78.3%), hiking off trails (65.2%), photography (58.7%), swimming or sunbathing (58.7%), nature study (50%), and spending time alone (50%).

Visitors were also asked to indicate which of these activities was the most important (Table 2). These activities included hiking on trails (44.4%), followed by camping (23.3%), spending time alone (8.9%), and nature study (6.7%). Visitors rated their own ability or skill in this activity on a scale of 1 to 9, with 9 being highly skilled. The average of visitor skill was 6.9.

It is also important to determine visitor motivations for coming to the Dolly Sods. Twenty motivation items were rated by visitors for their importance, with 1 being most important and 5 being least important (Table 3). The highest-rated items were being outdoors and experiencing nature (1.36), viewing scenery (1.41), experiencing tranquility, peace, and calm (1.45), getting away from regular routine (1.54), getting away from the crowds (1.57), and getting away from human sights and sound (1.73).

Table 1. Activities Visitors Participated in while in the Dolly Sods. Dolly Sods Wilderness Study, September 1991.

Activity	Percent Participating	Activity	Percent Participating
Hiking on trails	99.0%	Other	30.4%
Camping	78.3%	Birdwatching	26.1%
Hiking off trails	65.2%	Collect berries, mushrooms	19.6%
Photography	58.7%	Fishing	7.6%
Swimming or sunbathing	58.7%	Hunting	1.1%
Spending time alone	50.0%	Horseback riding	0
		Check out places to hunt	0

Table 2. Visitors' Most Important Activity. Dolly Sods Wilderness Study, September 1991.

Activity	Percent indicating Most Important	Activity	Percent Indicating Most Important
Hiking on trails	44.4%	Fishing	1.1%
Camping	23.3%	Photography	1.1%
Spending time alone	8.9%	Hunting	0
Nature Study	6.7%	Checking out places to hunt	0
Other	6.7%	Collect berries, mushrooms	0
Hiking off trails	3.3%	Picnicking	0
Swimming or sunbathing	3.3%	Horseback riding	0

Table 3. Motivations for Visiting Wilderness Areas. Dolly Sods Wilderness Study, September 1991.

Rank	Motivation	Mean[1]
1	to be outdoors and experience nature	1.36
2	to view the scenery	1.41
3	to experience tranquility, peace and calm	1.45
4	to get away from the regular routine	1.54
5	to get away from the crowds	1.57
6	to get away from human sights and sounds	1.73
7	to learn more about the outdoors	2.15
8	to keep physically fit	2.24
9	to experience the challenge	2.51
10	to be free to make my own choices	2.73
11	to think about my personal values	2.82
12	to be with my friends	2.91
13	to test my abilities	2.98
14	to develop my skills	3.07
15	to do something with my family	3.24
16	to share what I know with others	3.37
17	to have thrills and excitement	3.53
18	to take chances in dangerous situations	4.08
19	to make new friends	4.32
20	to show others I can do it	4.42

[1] A rating of 1 indicated high importance, and 5, low importance.

Importance Ratings of Wilderness Indicators

The most important indictors of quality wilderness conditions for visitors were the number of parties camped within sight or sound of their campsites, the number of large parties (over 6 people) that were seen in the area, the number of parties of people seen in the area, and the number of parties walking past their campsite (Table 4). The least important indicators were presence of culverts and horse use in the wilderness.

In addition, visitors were asked if there were any other factors that influenced the quality of their experience in the wilderness area. Factors mentioned included cleanliness of area (22.6%), presence of wildlife (13.2%), well-blazed trails (9.4%), and presence of aircraft (7.5%). A complete list of these factors is presented in Appendix A.

Preferred Conditions

Overall, visitors were not tolerant of seeing other parties near their campsites. They preferred to see only .24 parties camped within sight or sound of their campsite, with a a maximum acceptable number at 1.4 (Table 4). The preferred number of parties walking past their campsite was only .39 parties, with the maximum acceptable level somewhat higher at 2.3 parties.

Visitors were more tolerant of seeing other people during the day. The preferred number of parties seen each day was 2.6, with the maximum number of parties at 8.7. Large groups (more than six people) were not well accepted, with visitors preferring to see only .61 parties each day, and the maximum level at 2.4 parties.

Visitors were also not tolerant of seeing bare ground and vegetation loss around campsites. Visitors preferred to see only 4.6% vegetation loss around campsites. The maximum level was higher, at 17.3% vegetation loss.

Actual Conditions

As stated earlier, the actual conditions of the wilderness indictors was determined two ways: the survey instrument and the field inventories. The survey instrument was used to determine the actual condition of several indicators, including total number of parties camped within sight or sound of campsites, the total number of parties walking past their campsite, the total number of parties seen while traveling in the area, the number of horse parties encountered while traveling in the area, the number of large parties seen while in the area, and the number of visible places seen while in the area. From the field inventory, we were able to determine the number of firerings, as well as vegetation loss and bare ground in each campsite. The results are presented in Table 4.

Table 4. A Comparison of Preferred, Maximum, and Actual Social and Environmental Conditions, and the Importance of those Conditions. Dolly Sods Wilderness Study, September 1991.

Item	Importance Rank	Importance Rating*	Visitor Tolerance Levels		
			Preferred Level	Maximum Level	Actual Level
Number of parties of people I see each day	3	4.0	2.6	8.7	3.8
Number of large parties (more than 6 people) I see each day	2	4.3	.61	2.4	.4
Number of parties camped within sight or sound of my campsite	1	4.3	.24	1.4	.7
Number of parties that walk past my campsite each night	4	4.0	.39	2.3	1.0
Number of visible places I see each day where people have camped	9	3.5	2.5	7.1	7.2
Number of horse parties encountered each day	11	3.1	.80	1.8	0
Percent of vegetation loss and bare ground I see around where people have camped	7	3.7	4.6	17.3	20.65
Number of firerings	8	3.5	1.6	2.3	1.03

*Importance ratings for four items, presence of culverts (2.81), miles of maintained trails (3.86), condition of trail system (3.90), and the presence of signs within the wilderness (3.26), are not listed above because visitors were not asked to give preferred, maximum, or actual ratings for these items.

Crowding

We also felt it was important to determine visitor opinions regarding crowding levels in the Dolly Sods. To measure crowding, a nine point scale developed by Heberlein and Vaske (1977) was used. The scale is useful because it can measure degrees of crowding. This scale has emerged as the standard by which crowding is measured in backcountry settings. The first two points on the scale represent uncrowded conditions, while a rating of three or more represents crowding to some degree.

To see if there were any differences among the weekday and weekend user, we measured these two groups separately for this question. Weekday users reported feeling crowded 42.9% of the time. The weekend user reported feeling crowded 60% of the time. These ratings are interpreted on page 20.

Trail Use

To gain a better understanding of which trailheads and trail segments were used most frequently, visitors were asked to map where they entered and exited the wilderness, as well as where they had hiked and camped. We then calculated each time a group walked on a trail segment. The use on each segment was then divided by overall trail use, providing an estimate of the percentage of total trail use in the Dolly Sods occurring on that segment. The results are presented in Figure 1. Trail use intensity is summarized in 5 categories, 0-3%, 3.1-6.0%, 6.1-9.0%, 9.1-12%, and greater than 12%.

The Red Creek trail was the most frequently used trail, with the Laneville segment receiving the highest amount of overall use. Fourteen percent of total trail use in the Dolly Sods occurred on this segment. We estimate over 50% of trail use in the Dolly Sods was concentrated on the Red Creek Trail. Blackbird Knob and Fisher Spring trails are also heavily used. The upper Fisher Springs trail, Wildlife trail, and the High Water Route on Red Creek were the lowest used trail segments.

Resource Inventory Results

Measuring resource conditions in the Dolly Sods was an important part of the study process. A total of 100 campsites in the Dolly Sods were identified by the field crews. As mentioned earlier, a number of indicators were chosen to describe the campsite conditions in the Dolly Sods. The following findings are presented as an overall average of campsite conditions in the Dolly Sods.

The volume of trash averaged .19 gallons per campsite, with .11 human waste sites per site (Table 5). The exposure of mineral soil onsite was 19.73%, compared with only 4.21% on similar control sites with no impact. The number of trees damaged or felled

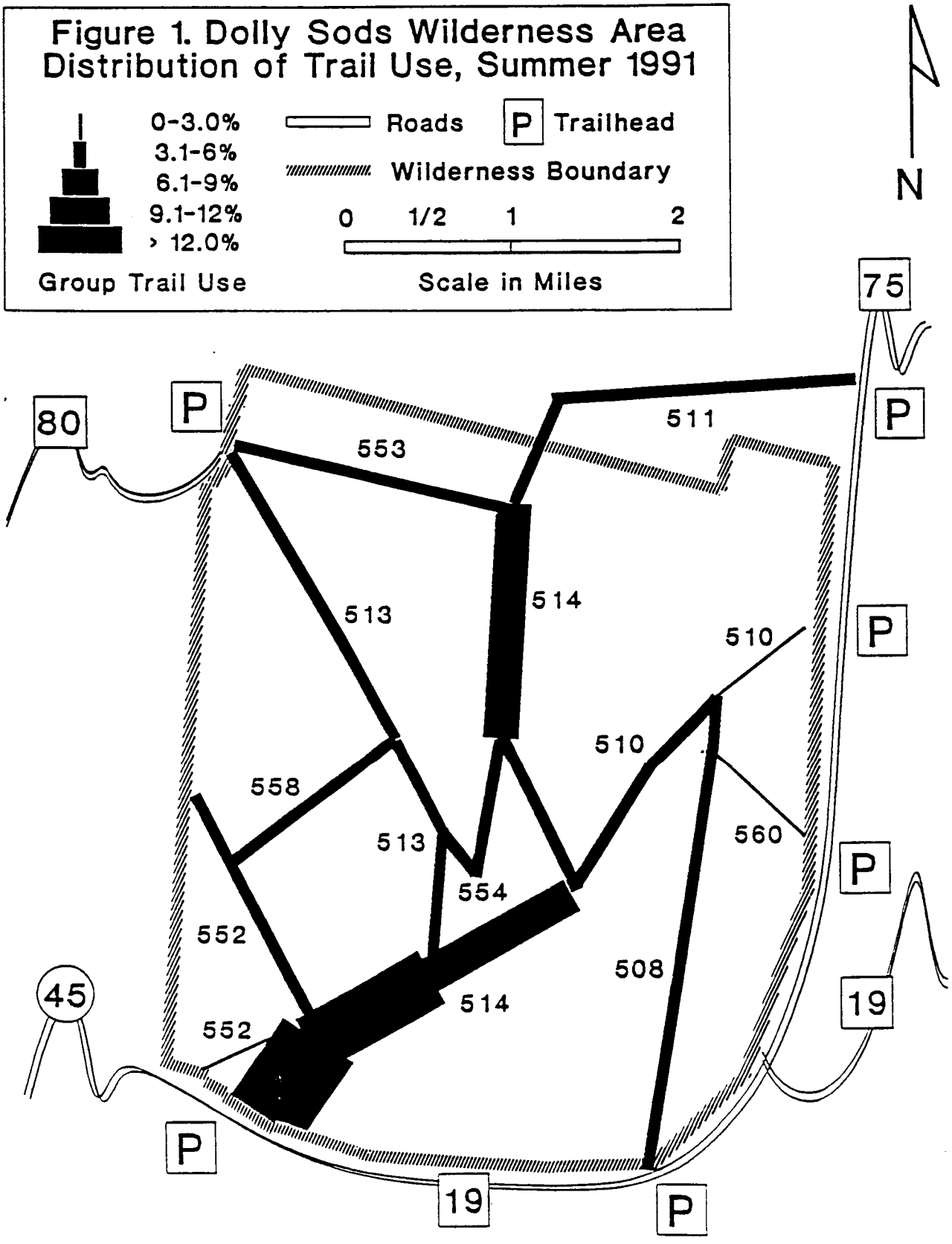


Figure 1. Dolly Sods Wilderness Area
Distribution of Trail Use, Summer 1991
0-3.0%
3.1-6%
6.1-9%
9.1-12%
> 12.0%
Group Trail Use
Roads
P Trailhead
Wilderness Boundary
0 1/2 1 2
Scale in Miles
N
75
80
P
511
553
514
513
510
558
513
554
552
560
508
45
552
514
19
19

Table 5. Actual Levels of Social and Environmental Conditions of Campsites in the Dolly Sods Wilderness. Dolly Sods Wilderness Study, September 1991.

Indicator	Average[1]
Volume of Trash (gal.)	0.19
Number of Human Waste Sites	0.11
Length of Shoreline Disturbance (m.)	0.58
Number of Facilities	0.41
Firerings[2]	1.03
Primitive seats	0.83
Constructed seats	0.13
Fire racks	0.04
Game poles	0
Vegetation Cover	
Offsite (%)	59.63
Onsite (%)	20.65
Difference in Cover	38.98
Mineral Soil Exposed[3]	
Offsite (%)	4.21
Onsite (%)	19.73
Difference in Exposure	15.52
Number of Trees Damaged or Felled	4.09
Number of Fire Scars[4]	1.25
Barren Core Camp Area (sq.m.)	42.91
Median	*37.91*
Total Camp Area (sq.m.)	58.79
Median	*49.80*

[1] Mean averages unless otherwise indicated.
[2] A fire site was considered a firering if the ring of stones was there; if the stones were scattered, it was a fire scar.
[3] Calculations do not include sites located on sand spits and other areas with natural mineral exposure.
[4] The number of fire scars, including firerings.

around each site was 4.09. There were also 1.10 fire rings and 1.25 fire scars per site.

The barren core describes the amount of vegetation depleted around a site. The impact area of a site is the total area that has been disturbed by human use. The average barren core camp area was 42.91 square meters, and the median area was 37.91 square meters. The average campsite area impacted was 58.79 square meters, and the median is 49.80 square meters.

Additionally, an impact index composed of several indicators, including vegetation loss, mineral soil exposure, tree damage, cleanliness, root exposure, development, and the number of social trails, was calculated, giving a single numerical rating to the condition of each individual campsite (Appendix C). Thus, lower index numbers describe campsites that have less resource damage, while higher impact indexes indicate that resource damage is high in that area. The campsite indexes range from a high of 50 to a low of 20 (Figure 2). Forty-seven exhibited moderate levels of damage, receiving impact index scores between 31 to 40. A substantial number of campsites (29%) occur in the 40's, indicating a sizable number of areas with high levels of damage.

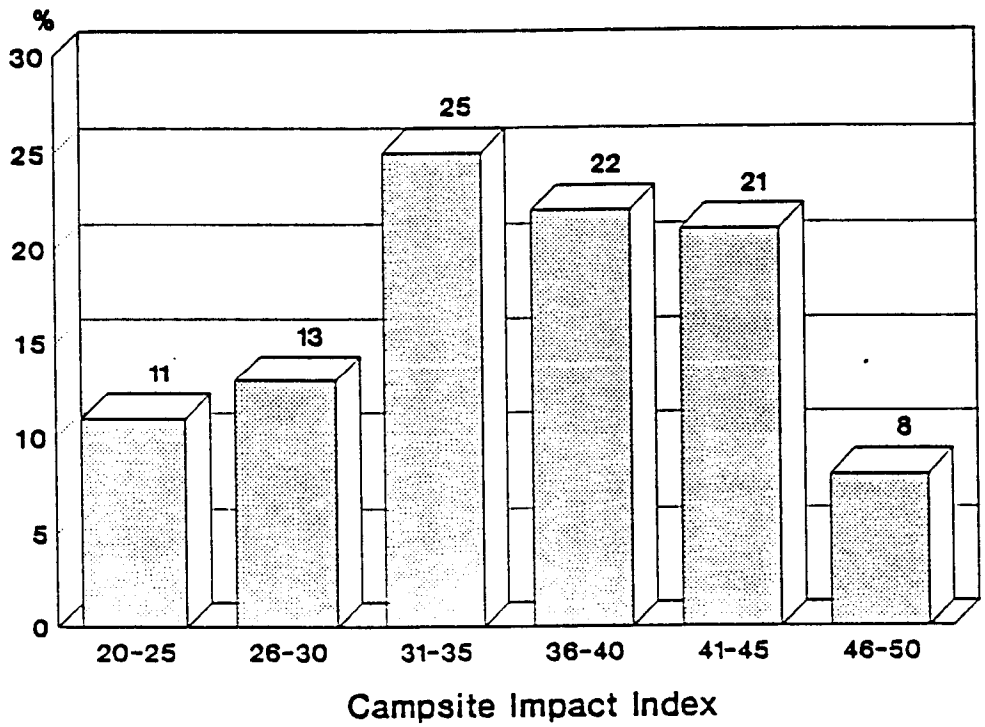


Figure 2. Distribution of Campsite Impact Index Scores. Dolly Sods Wilderness Study, September 1991.

COMBINING THE RESULTS

Indicator Performance Estimate

It was important to determine if actual conditions exceeded visitors' tolerance levels, and to relate these comparisons to the importance rating for each indicator. Two types of visitor tolerances were measured. "Preferred" ratings indicate ideal or desirable conditions. "Maximum" ratings indicate the highest acceptable level. For the preferred ratings, five actual conditions exceeded the preferred conditions (Table 4). For the maximum ratings, two items exceeded the actual conditions.

To relate these findings to the importance ratings, an Importance-Performance approach was used to visually present the data. The Importance-Performance approach uses a matrix divided into four sections. Each area is labeled differently to indicate different management priorities (Figure 3). ***Keep up the good work*** indicates that the visitor rated this item as important to their wilderness experience, and that actual conditions are not exceeding visitors' preferred or maximum conditions. ***Possible overkill*** indicates that visitors rated this item of low importance, and the actual conditions are not exceeding the preferred or maximum conditions. ***Low priority*** is of low importance to the visitor, but for these items, the actual conditions are exceeding the preferred or maximum conditions. The area ***Concentrate here*** indicates to the manager that these items are very important to the visitor's experience, and that these conditions are exceeding preferred or maximum conditions.

However, indicators are measured using different scales (i.e. volume of litter, number of parties seen each day, etc.) and are therefore not directly comparable. To deal with this problem, we standardized the difference between visitor tolerance levels and actual conditions using the following formula:

$$IPE_i = t_i - a_i / st_i$$

where:

IPE_i = indicator performance estimate of indicator i
t_i = mean visitor tolerance levels for indicator i
a_i = mean actual condition of indicator i
st_i = the standard deviation of the distribution for t_i

The formula assumes that higher indicator values represent poorer wilderness conditions (i.e. number of parties encountered). For indicators in which higher indicators indicate positive conditions (i.e. wildlife sightings), t_i would be subtracted froma_i.

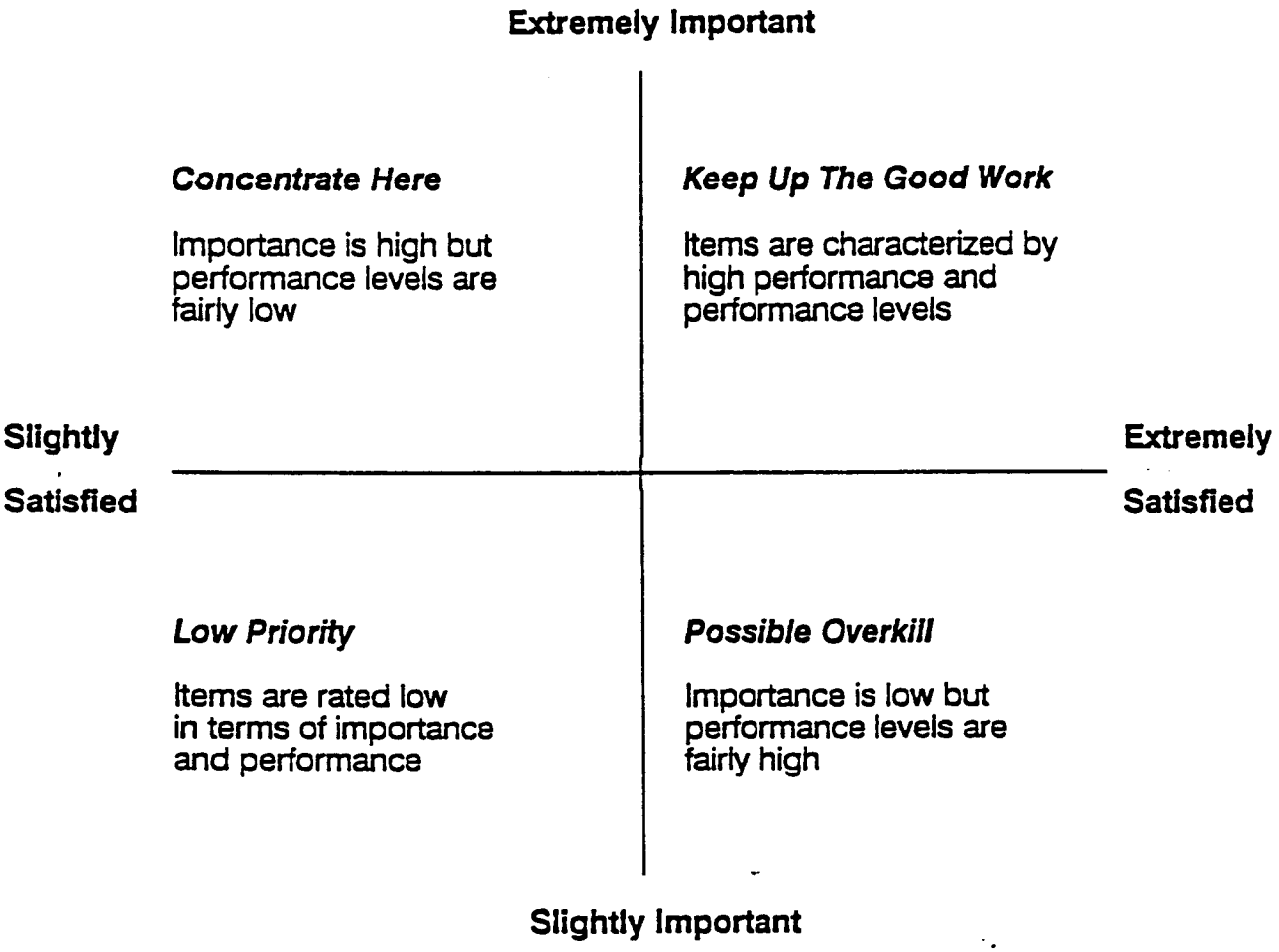


Figure 3. Importance-Performance Matrix. *Source: Mengak, K.K., F.D. Dottavio and J.T. O'Leary. 1986. Use of Importance-Performance Analysis to Evaluate a Visitor Center.* ***Journal of Interpretation*** *11(2):1-13.p.4*

The resulting IPE values can best be viewed as performance ratings. By standardizing the difference between visitor tolerance and actual conditions, indicators could be campared directly. Positive IPE values occurred when actual conditions fell within visitor tolerances. Conversely, negative IPE values occurred when actual conditions exceeded these tolerances. IPE values for each indicator are presented in Table 6.

The next step was to calculate and position the crosshairs for the Importance-Performance matrix. Most studies which have used the Importance-Performance analysis in the past have positioned the cross-hairs at the median of the scale used (i.e. placed at 4 on a 7-point scale). Since the means and median were similar and the data were fairly normally distributed, it was decided to use the mean of all importance ratings of wilderness quality to position the crosshair. The results were then presented visually on the Importance-Performance matrix. This was done for both types of visitor tolerances: preferred (Figure 4) and maximum (Figure 5) levels.

Preferred Conditions on the Importance-Performance Matrix

For the preferred conditions, three indicators appeared in the ***Concentrate here*** category, including the number of parties of people seen each day, the number of parties camped within sight or sound of their campsite, and the number of parties walking past their campsite each night (Figure 4). Visitors felt that these conditions were important to their wilderness experience, but they rated the condition of these indicators as poor (exceeding their preferences). One indicator, percent of vegetation loss and bare ground seen where people have camped, bordered this category. Visitors rated this condition of moderate importance in relation to the previous indicators, but rated performance was extremely low.

In the ***Keep up the good work*** category, one indicator, the number of large parties (more than 6 people) seen each day, appeared. Visitors found this condition important to their wilderness experience, and rated performance high.

In the ***Possible overkill*** category, two indicators appeared, including the number of horse parties encountered each day, and the number of firerings. This indicates that these conditions were rated high in performance, but they were not as important to the visitor as other conditions.

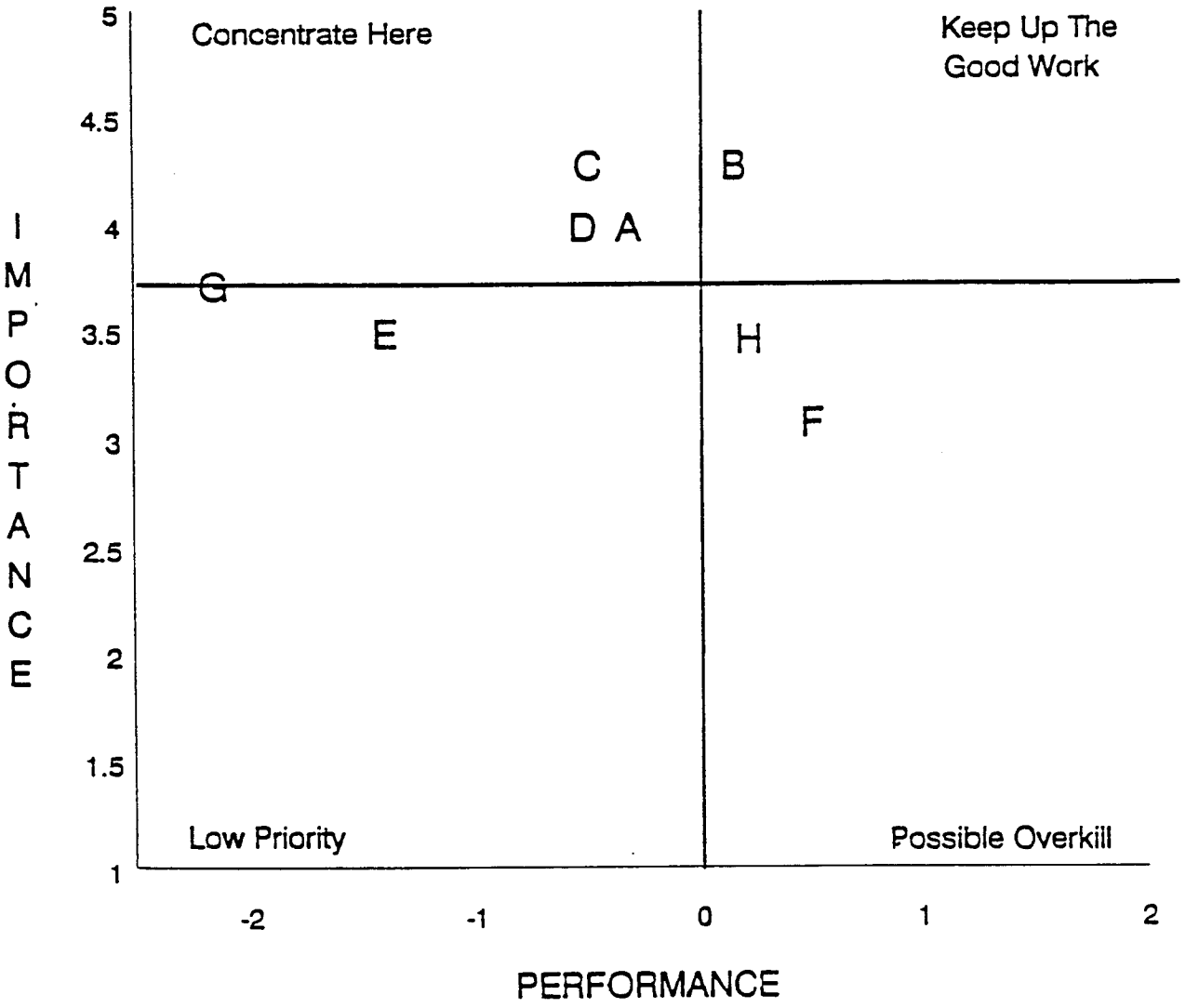
The number of visible places seen each day where people have camped fell into the ***Low priority*** category. Visitors found this condition of lower importance to their wilderness experience in relation to the previous indicators. Performance of this condition, however, was also rated low.

Table 6. Indicator Performance Estimate (IPE) Values for Various Indicators of Wilderness Conditions. Dolly Sods Wilderness Study, September, 1991.

Indicator	Indicator Performance Estimate	
	Preferred*	Maximum
Number of parties of people I see while in the area each day	.58	-.34
Number of large parties (more than six people) that I see while in the area each day	.60	.15
Number of parties camped within sight or sound of my campsite each night	.34	-.51
Number of parties of people that walk past my campsite each night	.55	-.52
Number of visible places I see each day where people have camped each day	-.01	-1.4
Number of horse parties encountered while in the area each day	.9	.49
Percent of vegetation loss and bare ground I see around where people have camped	-.24	-2.15
Number of firerings around places where people have previously camped	.27	.22

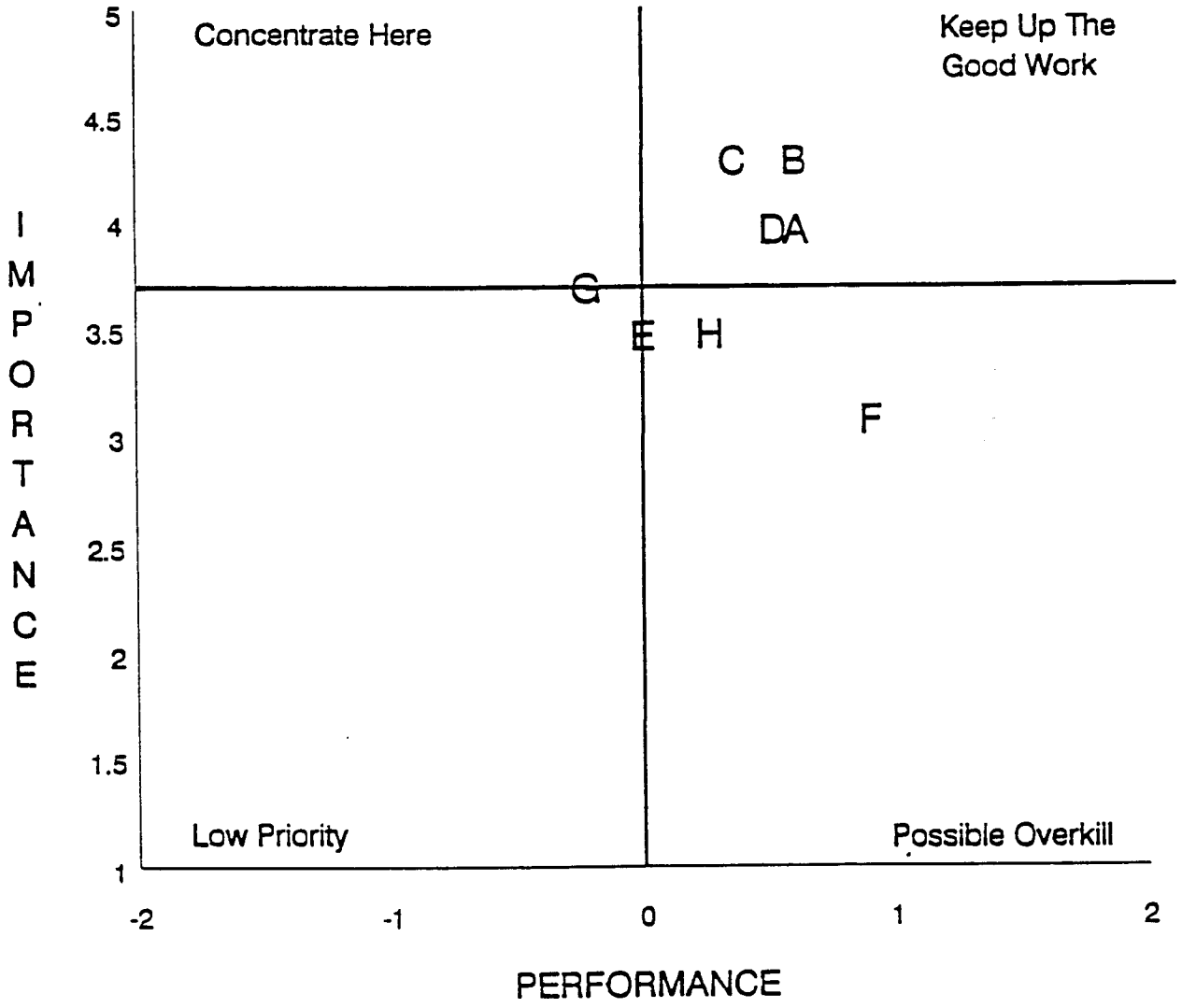
* Positive IPE values indicate when actual conditions are within visitor tolerances. Negative IPE values occur when actual conditions exceed tolerances.

Figure 4. Importance-Performance Ratings of Wilderness Indicators: Preferred Conditions: Dolly Sods Wilderness Study, September 1991.



Code	Indicators
A	Number of parties of people I see each day
B	Number of large parties (more than 6 people) I see each day
C	Number of parties camped within sight or sound of my campsite
D	Number of parties that walk past my campsite each night
E	Number of visible places I see each day where people have camped
F	Number of horse parties encountered each day
G	Percent of vegetation loss and bare ground I see around where people have camped (from campsite inventory)
H	Number of firerings

Figure 5. Importance-Performance Ratings of Wilderness Conditions: Maximum Acceptable Conditions. Dolly Sods Wilderness Study, September 1991.



Code	Indicators
A	Number of parties of people I see each day
B	Number of large parties (more than 6 people) I see each day
C	Number of parties camped within sight or sound of my campsite
D	Number of parties that walk past my campsite each night
E	Number of visible places I see each day where people have camped
F	Number of horse parties encountered each day
G	Percent of vegetation loss and bare ground I see around where people have camped (from campsite inventory)
H	Number of firerings

Maximum Conditions on the Importance-Performance Matrix

The maximum acceptable conditions for the wilderness indicators were higher than the preferred conditions (Figure 5). None of the indicators fell into the ***Concentrate here*** category, but one indicator, percent of vegetation loss and bare ground seen where people have camped, bordered this category. As before, the rated importance was fairly high, but performance ratings were low.

In the ***Keep up the good work*** category, four indicators occurred, including number of parties of people seen each day, number of large parties (more than 6 people) seen each day, number of parties camped within sight or sound of their campsite, and the number of parties walking past their campsite each night. Performance of these conditions was rated highly.

Two indicators, number of horse parties encountered each day, and the number of firerings occur in the ***Possible overkill*** category. Importance of these indicators were of lower importance to the visitor, but the performance of these conditions were also rated fairly high. One indicator, number of visible places seen each day where people have camped, falls between this category, and the ***Low Priority*** category. Importance of this condition to the visitor was rated lower in relation to other indicators, but performance was neither high nor low.

MANAGEMENT IMPLICATIONS

Importance-Performance Analysis

Figures 4 and 5 visually show how important each indicator was to visitors, and how well the Dolly Sods met their preferred and acceptable conditions. The indicators that visitors rated higher in importance were those relating to encounter rates with other visitors on the trail and at campsites. Performance was rated low, however, suggesting that management attention should be focused on reducing encounter rates, dispersing campsites, and obliterating campsites in order to provide a higher quality experience for visitors. Because the Red Creek corridor is highly used, reducing the amount of use it receives by shifting use to other areas could help lessen campsite and trail encounters.

The number of large parties, although important to visitors, does not seem at this time to be a management concern. Additionally, the amount of horse use and the number of firerings per campsite are rated high in performance, suggesting that management attention in these areas can be shifted to those other conditions that are being exceeded.

Crowding

Visitors reported that three conditions important to the quality of their wilderness experience are being exceeded. These include the number of parties seen each day, the number of parties camped within sight or sound of their campsites, and the number of parties walking past their campsites. In addition, 60% of weekend and holiday visitors report feeling crowded, and 42.9% of weekday users report feeling crowded.

Is social carrying capacity being exceeded in the Dolly Sods? To determine this, Shelby et al. have developed a table dividing crowding into five levels based on the percentage of visitors reporting some degree of crowding. For each level, specific management prescriptions are provided (Table 7). The prescriptions reflect the way other wilderness managers have responded when crowding reaches these levels in the areas they manage.

As can be seen from the table, the Dolly Sods falls into the "Low Normal" category during the weekday period (42.9% of visitors reported feeling crowded). It does not appear that a crowding problem exists at this time. If visitors arrive on weekdays, they can reasonably expect low density experiences.

During the weekend and holiday period, however, the Dolly Sods is judged as "High Normal" (60% of visitors report feeling crowded). Currently, there is some perception of crowding on weekends, but it is still within acceptable levels, at least as compared to

Table 7. Carrying Capacity Judgment Based on Levels of Perceived Crowding (Shelby et al. 1989).

Percentage of visitors feeling crowded	Capacity judgment	Comments
0-35	Suppressed Crowding	Crowding limited by management or situational factors; may offer unique low-density experiences.
35-50	Low normal	Problem situation does not exist at this time; as with the above category, may offer unique low-density experiences.
50-65	High Normal	Should be studied if increased use is expected, allowing management to anticipate problems
65-80	More than capacity	Studies and management actions necessary to preserve experiences.
80-100	Much more than capacity	Manage for high-density recreation or sacrifice area.

other wilderness areas. However, if there are any expected changes in the amount of use that Dolly Sods receives, management should consider taking actions to preserve low density wilderness opportunities.

These conclusions are supported by the results of the Importance-Performance analysis. Respondants identified crowding factors as the most important indicators of wilderness quality in the Dolly Sods, but that they were dissatisfied with the condition of these indicators. It is interesting to note, however, that several of these indicators, number of parties camped within sight or sound of their campsite and the number of parties that walk past their campsite, can be reduced by managing the proliferation and location of campsites.

Resource Inventory

The barren core and the total impact area of campsites shown in Table 5 indicates that campsites in the Dolly Sods are fairly large. There is also substantial resource damage, such as fire scars, firerings, and numerous damaged and scarred trees in some sites. Visitors rated resource conditions of lower importance than social conditions, but they still felt that they were an important part of their wilderness experience. Two indicators, number of visible places seen each day where people have camped, and percent of vegetation loss and bare ground where people have camped, exceeded both preferred and maximum acceptable tolerance levels. The impact index shows that there are several campsites with extensive resource damage.

Management efforts to remove, disperse, and rehabilitate campsites would probably be favorably viewed, especially along the highly impacted Red Creek corridor. In particular, campsites visible from the trail or other campsites and adjacent the Red Creek should be considered candidates for removal. These actions would have an important positive influence on encounter levels (encounters), both in camp and while hiking, and would be less heavy-handed than tactics such as use limits and entry point permits.

Visitor use in the Dolly Sods is highly concentrated on the Red Creek corridor. In fact, we estimate that approximately 50% of total trail use occurred on the Red Creek Trail. The balance of use is distributed fairly across the rest of the trail system. It should be remembered that nearly all the campsites are also located within view of the Red Creek trail.

The result is high encounter levels and perceptions of crowding that border on being a severe problem. While it may be possible to disperse use to other trail segments, it seems more likely that crowding could be reduced by obliterating campsites visible along the Red Creek Trail. This would not reduce encounters with other parties

traveling in the area, but would reduce encounters with other campers and with parties walking past campsites. The major management challenge will clearly be identifying alternatives to the present pattern of camping adjacent to trails and along streams.

REFERENCES

Heberlein, T.A., and J.J. Vaske. 1977. Crowding and visitor conflict on the Bois Brule River (report WISC WRC 77-04). Madison WI: University of Wisconsin Water Resources Center.

Mengak, K.K., F.D. Dottavio and J.T. O'Leary. 1986. Use of Importance-Performance Analysis to Evaluate a Visitor Center. Journal of Interpretation 11(2):1-13.p.4

Shelby, B., J.J. Vaske, and T.A. Heberlein. 1989. Comparative analysis of crowding in multiple locations: results from fifteen years of research. Leisure Sciences, vol. 2:269-291.

APPENDIX A

1. Where do you currently reside? (please include zip code)

See attached page

2. a. How did you hear about the Dolly Sods Wilderness Area?

See attached page

b. Why did you choose the Dolly Sods Wilderness? _____

See attached page

3. How many people were in your party?

12% [ ] Alone [ ] Party —> 3.9 number of people

4. On this visit did your party spend the night in the Dolly Sods Wilderness Area?

81.5% [ ] YES —> If yes, GO TO QUESTION 5. 81.5%
18.5% [ ] NO —> If no, how many hours were you in the wilderness? 6.5 hours. GO TO QUESTION 7.

5. How many nights did you spend in the Dolly Sods? 2.09 nights.

6. For each of the first three nights you camped in the wilderness, please estimate:

	NIGHT 1	NIGHT 2	NIGHT 3	MEAN
a. the total number of parties camped within sight or sound of your campsite	.74	.75	.32	.7
b. the total number of parties that walked past your campsite	.76	1.2	1.5	1.0
c. the total number of parties you saw while traveling in the area	3.5	3.8	5.2	3.8
d. the number of horse parties encountered while traveling in the area	.01	0	0	.0

9. Below are some reasons why people visit wilderness areas. Please tell us how important each of these items is to you as a reason for visiting a wilderness area. 28

I visited the wilderness:	very important				not at all important	MEAN
to develop my skills	1	2	3	4	5	3.07
to make new friends	1	2	3	4	5	4.32
to get away from the regular routine	1	2	3	4	5	1.54
to keep physically fit	1	2	3	4	5	2.24
to experience the challenge	1	2	3	4	5	2.51
to be outdoors and experience nature	1	2	3	4	5	1.36
to experience tranquility, peace and calm	1	2	3	4	5	1.45
to be with my friends	1	2	3	4	5	2.91
to take chances in dangerous situations	1	2	3	4	5	4.08
to have thrills and excitement	1	2	3	4	5	3.53
to test my abilities	1	2	3	4	5	2.98
to show others I can do it	1	2	3	4	5	4.42
to get away from the crowds	1	2	3	4	5	1.57
to do something with my family	1	2	3	4	5	3.24
to view the scenery	1	2	3	4	5	1.41
to be free to make my own choices	1	2	3	4	5	2.73
to think about my personal values	1	2	3	4	5	2.82
to get away from human sights and sounds	1	2	3	4	5	1.73
to share what I know with others	1	2	3	4	5	3.37
to learn more about the outdoors	1	2	3	4	5	2.15

10. We are interested in finding out what types of things influence the quality of your wilderness experience in the Dolly Sods. For the items listed below tell us how how much each matters to you.

I care about:	Not At All		Moderately		Extremely	MEAN
The number of parties of people I see while in the area	( )	( )	( )	( )	( )	3.98
The number of large parties (more than 6 people) that I see while in the area	( )	( )	( )	( )	( )	4.25
The number of parties that camped within sight or sound of my campsite	( )	( )	( )	( )	( )	4.33
The number of parties that walk past my campsite	( )	( )	( )	( )	( )	3.96
The amount of vegetation and bare ground around where people have camped	( )	( )	( )	( )	( )	3.65
The number of campfire rings that people have made	( )	( )	( )	( )	( )	3.50
The number of visible places where people have previously camped	( )	( )	( )	( )	( )	3.47
Horse use in the wilderness	( )	( )	( )	( )	( )	3.10
Evidence of human works (culverts, shelters, etc.)	( )	( )	( )	( )	( )	2.81
Miles of maintained trails	( )	( )	( )	( )	( )	3.86
Condition of trail system	( )	( )	( )	( )	( )	3.90
The presence of signs within the wilderness	( )	( )	( )	( )	( )	3.26

11. Are there any other factors that influence the quality of your wilderness experience in the Dolly Sods Wilderness Area?

See attached page.

12. The managers of Dolly Sods Wilderness Area would like to know how you rate specific conditions within the wilderness. This will allow them to make management decisions based on what conditions you rate as preferred or unacceptable. Please fill in the blanks below with the maximum number you would like, and then the number you would most prefer to see.

MEAN SCORES

A. The number of parties of people I see while in the area each day.
   Maximum: 8.7 parties
   Preferred: 2.6 parties

B. The number of large parties (more than 6 people) that I see while in the area each day.
   Maximum: 2.4 parties
   Preferred: .61 parties

C. The number of parties camped within sight or sound of my campsite each night.
   Maximum: 1.4 parties
   Preferred: .24 parties

D. The number of parties of people that walk past my campsite each night.
   Maximum: 2.3 parties
   Preferred: .39 parties

E. The number of visible places I see each day where people have camped.
   Maximum: 7.1 visible places
   Preferred: 2.5 visible places

F. Number of horses parties encountered each day while in the area .
   Maximum: 1.8 horse parties
   Preferred: .30 horse parties

G. Width of trail tread.
   Maximum: 5.1 feet
   Preferred: 2.7 feet

H. Directional signs within the wilderness.
   [ ] None 2.3% of visitors
   [ ] At trail junctions only 73.7% of visitors
   [ ] At regular intervals along the trail 26.7% of visitors

I. Percent of time spent on wet or muddy trails.
Maximum: 34.5 percent of the time
Preferred: 11.9 percent of the time

J. Percent of vegetation loss and bare ground I see around where people have camped.
Maximum: 17.3 percent of vegetation loss and bare ground
Preferred: 4.6 percent of vegetation loss and bare ground

K. Number of firerings around places where people have previously camped.
Maximum: 2.3 firerings
Preferred: 1.6 firerings

L. The number of culverts that I see while in the area.
Maximum: 3.4 culverts
Preferred: 1.2 culverts

13. Will you return to the Dolly Sods Wilderness? Why or why not?

See Appendix C

14. Additional comments about your experience in the Dolly Sods Wilderness.

See Appendix C

15. We want to learn more about what trails visitors use and where they camp. Your responses to the next set of statements may be the most difficult to recall and the most difficult for us to record, so please be as specific as possible. Use the map of the Dolly Sods on the opposite page for your responses to the following statements.

    1. Mark your point(s) of entry into the wilderness area with "A".

    2. Mark your point(s) of exit from the wilderness area with "B".

    3. Draw a solid arrow ————> along your trail routes with the front of the arrow pointing in the direction of travel.

    4. Draw a broken arrow - - - - - -> to indicate off-trail travel, with the front of the arrow pointing in the direction of travel.

    5. Mark your campsite locations on the map with an "X" and the number of nights you spent at each campsite. For example, if you camped two nights at one site, indicate "X2".

1. State Percent

Virginia	33%
Maryland	22
West Virginia	16.9
Pennsylvania	11
Washington, DC	9.9
Ohio	3.3
Other	3.3
Michigan	1.1

2A. Heard about Dolly Sods from:

Friends/Family	60%
Literature/Media	16.7
Don't remember	6.7
Clubs/School	5.6
Travelling in Area	3.3
Other	3.3
Live Nearby	2.2
Hiking Store	2.2

2B. Chose Dolly Sods because:

Beauty	20%
Isolation	12.2
Location	12.2
Unusualness	11.1
Never been there/ sounded interesting	10
Like it/Been going there for years	10
Other	8.9
Recommendation	5.6
Varied terrain	4.4
Wilderness	4.4
Club Outing	1.1

7B. Most Important Activity:

Hiking on trails	44.4%
Camping	23.3
Spending time alone	8.9
Other	6.7
Nature Study	6.7
Hiking off trails	3.3
Swimming	3.3
Fishing	1.1
Photography	1.1
Birdwatching	1.1

11. Other Factors. There were 54 respondents to this question.

Cleanliness	22.6%
Seeing Wildlife	13.2
Other	17
Well-Blazed Trails	9.4
Presence of Aircraft	7.5
Quality of Maps Available	5.7
Natural Conditions (rain, insects, etc.)	3.8
Trail Conditions	3.8
Sign Conditions/Number of Signs	3.8
Amount of Wilderness	3.8
Behavior of Others	1.9
Water Quality	1.9
Security	1.9
Horses	1.9
More Trails	1.9
Mountain Bikes	1.9

APPENDIX B

Dolly Sods Campsite Index. Dolly Sods Wilderness Study, September 1991.

CAMPSITE NO.	INDEX
50801	32
50802	44
50803	39
50804	28
50805	34
50806	25
50807	27
50808	31
50809	38
50810	22
50811	22
50812	31
50813	31
50814	42
50815	48
50816	40
50817	42
50818	25
50819	33
51001	33
51002	42
51003	34
51004	20
51005	20

CAMPSITE NO.	INDEX
51301	27
51302	41
51303	36
51304	41
51305	37
51306	39
51307	40
51308	44
51309	31
51310	37
51311	38
51312	35
51313	39
51314	45
51401	35
51402	34
51403	24
51404	50
51405	27
51406	20
51407	40
51408	40
51409	39
51410	25
51411	33

CAMPSITE NO.	INDEX	CAMPSITE NO.	INDEX
51412	25	51438	48
51413	35	51439	35
51414	29	51440	42
51415	47	51441	33
51416	31	51442	29
51417	36	51443	48
51418	33	51444	49
51419	45	51445	37
51420	37	51446	45
51421	40	51447	49
51422	35	51448	44
51423	42	51449	27
51424	33	51450	36
51425	45	55201	25
51426	43	55202	28
51427	26	55203	27
51428	33	55204	33
51429	43	55301	30
51430	36	55302	42
51431	39	55401	32
51432	46	55801	29
51433	44	55802	37
51434	41	55803	33
51435	42	56001	31
51436	37	56002	28
51437	43		

APPENDIX C

DOLLY SODS WILDERNESS SURVEY COMMENTS

Question 13--Will you return to the Dolly Sods Wilderness? Why or why not?
Question 14--Additional comments about your experience in the Dolly Sods Wilderness.

Survey 1
Question 13--Yes. I enjoy the relative isolation, proximity, natural beauty, and close to wilderness conditions. I would like to see efforts made to dismantle all firerings and prohibit any being left behind.
Question 14--Also, the trailmarkers (stacked rocks or tree blazes, could be updated just a little (see trails 514 and 511). Can there be some way to limit parties in size? Someone would have to monitor access, I guess. Maybe require reservations to lighten load on the environment (as at Rocky Mountain National Park in Colorado). To prevent building of firerings, prohibit wood fires, except where you build a cement ring (only a few places).

Survey 2
Question 13--Yes, Rocky Point.

Survey 3
Question 13--Yes, it's one of the best in Monongahela. The adjacent private land (Cabin Mountain and Dobbins Slashing) was sublime in the extreme.
Question 14--The deer population seems out of control. Fischer Spring Run trail and Red Creek trail North of 510 junction became extremely confusing in places. 510 would have been impossible without a topo map.

Survey 4
Question 13--Yes!! I love the Dolly Sods Area. The sights are beautiful, especially on top of the mountain. The trails are challenging and there is <u>generally</u> plenty of water. Although it is getting more crowded it is still less crowded than most areas (ex. Shenandoah Park).
Question 14--I enjoy being able to get a campfire going at night. That is one of the most pleasant aspects of being able to camp in this area. I would prefer not to see any other campfires at night around me. Even though it's not 100% true, I love the feeling of being totally alone (my group that is) in the wilderness. Solitude in the wilderness is like a gift from <u>God.</u>

Survey 6
Question 13--Yes: Beauty, variety, serenity, unique, challenge.
Question 14--Trail blazes help. Mileage at intersects are good for planning camping sites. Suggest signs at parking entry points telling hikers not to create new/more firerings.

Survey 7
Question 13--Of course.

Survey 8
Question 13--Yes. I had a positive wilderness experience.

Survey 9
Question 13--Yes. It was peaceful, beautiful, there was varied terrain, and it was very uncrowded.

Other comments-- If no trash is left, a flat space or camp fire ring is not offensive. It is actually reassuring when looking for somewhere to sleep. There should be enough signs to make trail system workable, but no more.

Survey 10
Question 13--Yes. Probably. As long as I can have an adequate amount of space, quiet and time alone.

Survey 11
Question 13--Yes.

Survey 12
Question 13--Yes.

Survey 13
Question 13--Yes. Very pretty, nice hiking. Would like to come back when the rhododendron are blooming, or when berries are ripe, too.
Question 14--The Rohrbough Trail was very pretty- lovely plants and trees with spectacular view near the campsites. Trail blazes were highly irregular, with ribbons, paint, round and rectangular marks and cairns and sometimes nothing at all. Didn't see a soul there, but saw two large parties and other couples later on the Wildlife Trail.

Survey 14
Question 13--Yes. Because it was very beautiful.

Survey 15
Question 13--Yes, It's an enjoyable weekend hike- the creeks are scenic.
Question 14--I'd like to see the area in a few hundred years- when it has recovered from the early logging of the 1850's.

Survey 16
Question 13--Yes. To show more people how beautiful it is and how peaceful life can be.
Question 14--Outside roads should be maintained more but over all a great time. More fresh water springs or any available.

Survey 17
Question 13--Absolutely. I've been coming for years, and still haven't taken some trails.
Question 14--I think the area is exceptionally beautiful and quite well maintained. My only uncomfortable experience was some two years ago when a friend and I came to Dolly Sods during the one day bear hunting season. That was a bit edgy.

Survey 18
Question 13--Maybe in the fall or winter when less people will be in the areas.
Question 14--Over the past two years I have noticed an increasing number of visitors to the area, especially on the Rohrbough Plains trail (approximately 20 people, mostly day hikers, in one day). This trail is over-hiked and too many people are damaging the area along the cliffs. I recommend the prohibition of camping in this area and some kind of management that would make this sensitive area less accessible to such large numbers of visitors. I am very interested in the results of your study and would like to know more about your management plan.

Survey 19
Question 13--Yes. It is one of the truly beautiful areas on the east coast offering a wide diversity of habitats. The north and western parts of the Sods remind me of Alaskan tundra and Canada. I will be back for sure.
Question 14--Being an avid animal lover, it disturbs me to see the amount of deer and bear hunting that goes on in Dolly Sods. I like to backpack in the fall and winter months and I have found myself at risk with hunters in the area. I know that it's difficult to reserve the Sods and the wildlife within, but I support any efforts to ban hunting. Most of the impact on the land comes from hunters.

Survey 20
Question 13--Yes, different types of vegetation and very scenic.
Question 14--The campsites were abused. One small firering is ok, but a 3 foot high ring with burnt logs around is too much.

Survey 21
Question 13--Yes, it is beautiful! It has all the aspects of a wilderness area we enjoy and it is convenient to Washington DC.

Survey 22
Question 13--No, too far away.
Question 14--Trails need consistent and more numerous blazes.

Survey 23
Question 13--Yes, it's close to DC relative to other WV locations and its a nice wilderness.
Question 14- Good, but trails should be better maintained. In some places, there were no signs at junctions.

Survey 24
Question 13--Yes, this was my first trip into the area and I saw only two other parties in a day and a half.
Question 14--A detailed map of the area with scenic areas marked needs to be made available.

Survey 25
Question 13--Yes, because it is remote enough to provide solitude and a peaceful "back to nature" feeling-but has enough "signs" of civilization to feel secure.
Question 14--I have been on a two night backpacking trip in Blackbird Knob -Red Creek trail area--other times just an hour or so to hike.

Survey 26
Question 13--Yes, because it is many many square miles of beautiful wilderness. It has the distinction of being situated to the west of the Allegheny Front, so it is a dissected plateau province much more interesting than the linear mountain chains to the east.
Question 14--The one large party that we encountered was lost, though I had no problem following the park maps or the USGS guad maps.

Survey 27
Question 13--Yes. It is a beautiful, interesting area, a gem in this region.
Question 14--I recommend you require back country campers to camp out of sight and sound of the trails, that you prohibit open air fires in the backcountry and prohibit hunting in the wilderness. The latter would do a lot to cut down on overuse of campsites and litter.

Survey 28
Question 13--Yes, Dolly Sods provides a beautiful, uncrowded get away.

Survey 29
Question 13--Enjoyed our backpacking experience in the Dolly Sods very much. The uniqueness and variety of forest, meadows, streams, plants and trees are incredible.
Question 14--We got lost!! Nothing serious-but missed a trail head. Would like to see trails more clearly marked.

Survey 30
Question 13--Yes, I love it.
Question 14--Hard time answering Question 12.

Survey 31
Question 13--More hiking and sightseeing. Look for beaver dams again, wildlife sitings, and blueberries.
Question 14--Why is there no sign to say that Bell Knob Tower is closed. What a disappointment.

Survey 32
Question 13--Yes, for birding and scenery.

Survey 33
Question 13--Yes. It's my favorite place to get away from it all.

Survey 34
Question 13--Yes. We enjoyed it. Beautiful area.
Question 14--Difficult walking on the rocks at Rocky Point trail.

Survey 35
Question 13--Yes, I backpack here mostly in winter, when there are very few people.

Survey 36
Question 13--Yes it is one of my favorite in the world but also convenient to my residence. I prefer the wilderness areas to state parks. This is a beautiful place that should be preserved.
Question 14--Larger signs for litter control too. I would like to see a moratorium on campfire use. Wilderness areas should be preserved, there is no need for campfires with today's modern stoves. Campfires lead to deforestation and litter. As people like to burn plastic, and throw bottles and cans into rings, please post signs at trailheads (campfires prohibited). I am very pleased to see this survey--I have in past written to rangers on ATV use and motorbikes in West Virginia. I have been on every trail over 15 year period and always select campsites not previously used and practice minimum impact camping-leaving no trace of having spent time (there?). Often I regret to say I remove others litter. Please do your best to preserve this fine piece of land from human destruction.

Survey 37
Question 13--Yes. Beautiful place that's still fairly primitive and uncrowded. There are few areas like it in the East. I still haven't seen the rhododendron bloom.
Question 14--There seems to be heavy use and dayhiking up from Laneville cabin. Why is the trailhead so wide? Reduce the jeep trail to a foot path.

Survey 38
Question 13--Yes, We love it!
Question 14--We backpack in spring, summer, and fall, and ski in winter at Dolly Sods.

Survey 39
Question 13--Yes, enjoyable, quiet with challenging hiking trails.
Question 14--Excellent area--keep up the good work. Tnx from the Virginian's.

Survey 40
Question 13--Yes, to finish backpacking out the trails and to enjoy the natural beauty of the Dolly Sods.
Question 14--I believe painted trail marks would keep people on the right trails and therefore keep people from bushwacking inadvertently. I also recommend the annexing of the land north of the Sods as far as Bear Rocks. Thank you.

Survey 41
Question 13--Yes. Due to its wilderness setting and low number of people.
Question 14--Loved it. I would like to obtain a better map and location of possible camping sites. I teach a class in backpacking at O.D.U. and would like to communicate with you. Also, I graduated from the College of Forestry at ODU in 1974. MS Wildlife Forestry. Address: Charles M. Smith, College of Education, Old Dominion University, Norfolk, VA 23529.

Survey 42
Question 13--Maybe, there's lots of other areas to explore.
Question 14--We came to see sphagnum bogs but the trail maps didn't indicate the best places to see them. Maps should have brief trail descriptions which tell what types of terrain and vegetation they traverse.

Survey 43
Question 13--Yes, it was nice.

Survey 44
Question 13--Yes. Dolly Sods is a very beautiful and varied area. Very conducive to backpacking. Based on this first experience I would say: 1. No new firerings or camp "engineering" should be allowed, and people should be required to use established areas. 2. While not a proponent of "highways" through the woods, I think some areas of trails need some better maintenance via use of ditches or "diverts" to channel away rain/runoff water. Some trails would be little more than streams in a rain, and some places, especially on hillsides, would be muddy and dangerous for walking without diverts to control the water. 3. By and large Dolly Sods appears well managed and hikers seem educated in backcountry use and etiquette. I saw very little human trash, except in the firerings. It seems people don't remove the un-burnable trash from the ashes. People I met on the trails were friendly and considerate. 4. An unusual sight-at the intersection of Big Stonecoal Run and Red Creek we saw a small adult female deer with 3 bandanas tied around her neck! Obviously very habituated to humans she approached us for food, but we did not feed her. Her coat has small spots of mange and she seems a bit scrawny ie. under-nourished. 5. Because Dolly Sods is a relatively small area, and obviously heavily used by day-hiker and campers, I feel that the number of parties of six or more should be controlled more closely. Perhaps all backcountry campers should be required to obtain a use permit and to camp near and use existing firerings/campsites. 6. There seems to be some confusion as to the status of trails on private land to the west and north (ie Blackbird Knob) of D.S. If these Trails are closed that fact should be published. If permits are required, they should also be

available at the ranger station in Petersburg. I would not want to drive to Davis VFD to get a permit,then backtrack all the way to D.S.

Survey 45
Question 13--Yes! We really enjoy the trails. Especially the Red Creek trail-I like the trails that follow the streams.
Question 14--I'm not a real lug camper but my friend is so I agree to go--only the Dolly Sods, Spruce Knob, Canaan area because it's so pretty and I feel safe there.

Survey 46
Question 13--Yes.

Survey 47
Question 13--Yes, very beautiful areas!
Question 14--Trails very dry as compared to normal. Nice weekend forecast brought a lot of people to the area. I saw a lot more people with day packs (one day trips) than previous years.

Survey 48
Question 13--Yes. Very close to home.

Survey 49
Question 13--Yes, the topography, the vegetation, the weather, the wildlife, the air, the trees, to creek, the fossils, the bogs, the blueberries, the rhododendron, the mountain laurels, etc. etc. I'm willing to tolerate the people if the natural assets of the area are maintained. Compared with other wilderness areas I've visited, the crowds weren't too bad. However, the evidence of former campsites (firerings) was very high compared with areas in the west.
Question 14--I enjoyed my visit, and look forward to returning again. I'm sorry to hear that hunting is allowed the area because I didn't feel safe hiking during hunting season.

Survey 50
Question 13--Yes, love the area, the mountains are great. Only 6 more years and my GS troop will be ready to do trail maintenance/did it previously in 76 and loved it.
Question 14--The old trail signs used to be great, telling how far you hiked from place to place. I've been bringing my kids to the area for 5 years my youngest was 2, and they like to see how far they hiked. Maps just don't do it with a 9 year old.

Survey 52
Question 13--Yes, I love the remoteness, the beauty of the meadows and woods, and do not mind sharing it.
Question 14--Some trails are becoming quite eroded. I hate to see this happen, but I realize lots of people use the trails here. I have had difficulty finding the turnoff where trail 514 (from Blackbird Knob) goes downhill to Red Creek Trail.

Survey 53
Question 13--Yes. Unusual attributes (bogs, etc.) Proximity to cross-country skiing and climbing areas. Blueberries. Mountain laurel. Not too crowded.
Question 14--Well maintained, but seeing hunters in woods makes me worry about being shot while off trail exploring-have seen hunters poaching where they should not be (P.S. I also enjoy hunting, but not where people are camping).

Survey 54
Question 13--Absolutely. It is well managed. The ranger we met-Rick Landenberger, was very informative and helpful. Everyone we met seemed like they really respected and cared about the area.

Survey 55
Question 13--Yes, to explore other areas, and also to bring our daughter in.
Question 14--It would be great if more of the northern areas (private land north of wilderness) could some day be included in wilderness area.

Survey 56
Question 13--I probably would come back to do a day hike or stay 1 night.
Question 14--I enjoyed the terrain and scenic beauty.

Survey 57
Question 13--Yes, to hike more of the trails.

Survey 58
Question 13--Yes, the place is beautiful. The habitat can contrast remarkably within a few miles of walking.
Question 14--It needs to be much larger. For the usage it gets, more acreage is definitely justifiable.

Survey 59
Question 13--Yes, because of the varied scenery and to a lesser degree, the backcountry campsites.
Question 14--Did a good job re-routing the trail (Red Creek) along the parts that were washed out by the flood.

Survey 60
Question 13--Yes, I really grooved on the solitude. I'd like to come back with a woman and spend time near Blackbird Knob.
Question 14--Great blueberries! Great water falls! The high meadows were fantastic. Bugs were not too bad.

Survey 61
Question 13--Yes. Beautiful country.
Question 14--Post signs for good water holes. I know all water needs treated, but on top water is very hard to find. We were a Boy Scout troop-would be nice to have a permit for more than 10 people (we could have).

Survey 62
Question 13--Very likely. Beautiful and geologically interesting.

Survey 63
Question 13--Yes. Best wilderness experience I've had.
Question 14--From what I saw, don't change anything.

Survey 65
Question 13--Yes, It's special and different-clear night sky.
Question 14--Want to further explore Red Creek for fishing. Want to see more of the plateau.
Other comments--Not offended by necessary culverts.

Survey 66
Question 13--Yes, to spend more time, possibly overnight, especially high elevation area.
Question 14--Trail up Big Stonecoal Creek in poor condition; no access trails to creek/falls.

Survey 67
Question 13--Yes, it was a beautiful and unique area, very pleasant.
Question 14--I strongly support the low impact wilderness qualities of Dolly Sods.

Survey 68
Question 13--Yes, always a great experience.

Survey 69
Question 13--Yes, it's beautiful and peaceful. Little sign of man, trails were fairly well marked.
Question 14--Not me, but a friend was camping here last fall and said the hunters were so unruly that she and her friends felt threatened all night long. That would probably end my visits to Dolly Sods.

Survey 70
Question 13--Yes. I did not have enough time to complete all the trails and would like to do so.
Question 14--After reaching campsites near overlook on trail 508 I could not find where trail continued. After searching for over an hour, I had to go back and take trail 560 to get to the road.

Survey 71
Question 13--Yes. The vegetation, terrain, and wildlife is unlike that of any other park or scenic area I have visited in WV. I would like to explore some other areas-perhaps overnight, but not at designated campgrounds.
Question 14--We saw very little garbage on trails or near wilderness campsites. The only place we saw trash was at scenic overlook on WV 75. We hiked for 6 hours on one day, and saw one party of two during hike and one man as we were leaving parking lot. One idea is to put garbage cans at "scenic" spots where people arrive by car.

Survey 72
Question 13--Definitely yes! It is a lovely place, allows campfires, has swimming holes and waterfalls.
Question 14--Too much trail maintenance leaves the trails looking like sidewalks. Some nice things have been done, but too much has been overdone. Please learn to balance the desires for minimal impact and trail maintenance!
Other comments--Regarding 12H, direction signs in the wilderness "the absolute minimum to ensure that people don't get lost. No more than two markers should be visible at one time-the one that you are at, and the next one down the trail.

Survey 73
Question 13--Yes, I've visited many times over the last 7 years. It's a wonderful place. In general I think Forest Service does a great job of managing it.
Question 14--Please post prominent signs at all trail heads advising people of regulations. Especially to pack out all trash. Establish stiff fines for offenders-and enforce them. I'm dismayed by the policies of landowners to North of wilderness (mt. Top hunting club, Pocahontas RR) and their refusal to allow access to this land to others. I think this land is being trashed and I fear it will extend into wilderness. I wish

Forest Service controlled this land--it is of exceptional beauty.
Other comments--No horses please!

Survey 74
Question 13--Definitely. Dolly Sods is too beautiful and important a wilderness area not to visit. Although I feel that all conditions in the wilderness can be improved, and should be, the quality of the wilderness is still high relative to non-wilderness areas of West Virginia.
Question 14--There are too many firepits apparently crafted by people who do not understand the importance of maintaining a minimum number of firerings. My experience included meeting future hunters and their hounds--apparently training for bear season. The practice of bear hunting is despicable and opportunities for training therefore should be minimized!

Survey 75
Question 13--Not in the near future--I would rather explore new/different areas.

Survey 76
Question 13--Yes.

Survey 77
Question 13--Yes. It is fascinating.
Question 14--Dolly Sods has become too popular, hence too populated. As much as I hate to say it, the Forest Service should limit use to preserve the habitats represented there as well as fine abusers.
Other comments: I expect Dolly Sods to be wet. This is N/A. (Question 12!)

Survey 78
Question 13--Yes. The number of people we see there thru the day in unimportant, but the numbers of rangers (3 the first morning) seems high. Very satisfied how things have been in the past.

Survey 79
Question 13--Yes. It's in an unusual area for this part of the U.S. It offers good opportunity for wilderness experience, scenery, and solitude.
Question 14--I took my 14 year old son for his first challenging backpacking trip and was happy to find the backcountry of the Sods virtually empty of people. Most hikers seem to stick to the established trail system below the Sods.

Survey 80
Question 13--Yes, quality of the wilderness experience. Variety of scenery types.
Question 14--Dolly Sods is our favorite area. Preferred over the Washington National Forest, Otter Creek, Shenandoah, and Cranberry Backcountry.

Survey 81
Question 13--Yes.

Survey 82
Question 13--Not for a while--it's a long drive.
Question 14--I hiked 17 miles and camped one night. The plateau has the appearance of a northern forest. Very fragile land. Trails should be better marked near stream crossings.

Survey 83
Question 13--Yes.

Survey 84
Question 13--Yes. Unique natural features.
Question 14--Protection of areas north of current boundary would enhance experiences.

Survey 85
Question 13--Yes, because of great trails, nice scenery, good wilderness area, berry picking, nice swimming holes. Not too many people.
Question 14--1. Consider improving trout habitat 2. Recycling trash containers at vehicular access points. 3. No hunting! 4. Minimum changes needed, after all it's a wilderness area. Except, of course, a very big restaurant and theme park. Thank you.
Other comments: In reference to culverts, "as many as needed!"

Survey 87
Question 13--Yes. It was beautiful, varied in types of vegetation groups and very scenic. I would like to see some more of the area, so I will come again.
Question 14--Although we did see quite a few groups, we were there on a holiday weekend. Additionally, although we would prefer not to see so many people while in the wilderness, I would be hesitant to limit access through having to make reservations, etc.

Survey 88
Question 13--It is a long drive from Philadelphia.

Survey 89
Question 13--Yes, quiet, isolated. We enjoyed the good hikes.
Question 14--No reservations necessary! It was like real man!

Survey 90
Question 13--You bet! It's a beautiful little wilderness just four hours from my door. Every trip there is always special. Just 2 days ago, my wife and I dropped our packs, put on our ponchos and hunkered down for 40 minutes while a tremendous thunderstorm rolled across Dolly Sods-we were on the Breathed Mt. Trail at the time, and a little exposed, but it was something. And there are groves of aspens up there and I love aspens. And besides, as far as I know, outside of New England, there is not other state on the east coast, including Virginia, that can offer such unique landscape as Dolly Sods and West Virginia in general! It is a very special place! And I think you're are doing a great job with it! Most of our trips here in the winter and this place, for me, becomes a magical world, complete solitude, and a quietness you can't find anywhere else, as far as I know.

Survey 91
Question 13--Probably not. Not enough feeling of remoteness; area too small and too many people, especially on Red Creek.
Question 14--Had a great time; Very beautiful.

Survey 92
Question 13--Yes, because it's beautiful.
Question 14--Signs marking the trail (i.e. blazes) were inconsistent and confusing. No trash was seen littering the trails. Very nice!

APPENDIX D

MONONGAHELA NATIONAL FOREST WILDERNESS CAMPSITE INVENTORY

GENERAL SITE DESCRIPTION

1. WILDERNESS AREA _____

   1. Dolly Sods 2. Cranberry 3. Otter Creek
   4. Laurel Fork North 5. Laurel Fork South

2. SITE NUMBER ___|__

3. USGS COORDINATES _____ | _____

4. DATE CODED (Mo/Day/Yr) __/__/__

5. CODED BY (names) _____

6. DOMINANT OVERSTORY _____

7. DOMINANT UNDERSTORY _____

8. LANDFORM _____

(Calculate in the office)

9. DISTANCE TO CLOSEST TRAILHEAD (miles) _____

10. a. DISTANCE TO TRAIL (meters) _____

    b. SCREENING FROM TRAIL (with foliage) _____
       1. Complete 2. Partial 3. None

11. a. DISTANCE TO WATER (meters) _____

    b. TYPE _____
       1. Creek 2. Spring 3. Pond

12. VOLUME OF TRASH PRESENT (gallons) _____

13. NUMBER OF HUMAN WASTE SITES _____

14. a. DISTANCE TO CLOSEST CAMPSITE (meters) _____

    b. SCREENING FROM CAMPSITES (with foliage) _____
       1. Complete 2. Partial 3. None

15. LENGTH OF SHORELINE DISTURBANCE (meters) _____

16. FACILITIES
    (Write number of each type in blank)

1 - Firering	_____	4 - Fire rack	_____
2 - Constructed seat	_____	5 - Primitive seat	_____
3 - Game pole	_____	6 - Other	_____

17. COMMENTS: (Details about location of site, impacts, management suggestions, etc.)

_____

_____

_____

_____

_____

_____

_____

_____

9-V-57

1. **Be consistent with measurements from site to site!**

2. **Do not leave any blank spaces!** *When in doubt, fill in answer, write any doubts in the comments.*

Item 2. Most of the known campsites for the Dolly Sods are identified on the campsite impact map. When additional impact sites are identified, number the site with the first 3 spaces being the closest trail or forest road. The last 2 spaces indicate the sites numbered consecutively, proceeding from south to north and from west to east. If a site is located at the junction of two trails, or if a site is accessible by two different main trails, number the site according to the more-common access.

Item 3. If the GPS is available, follow the instructions for its use. When a site is located and not identified by the GPS, make sure that it is marked on the map so identification can be made in the office.

Item 6. Describe the forest cover type consistent with the classifications in *"Forest Cover Types of the United States and Canada."* If tree crowns cover less than 25%, then indicate the type of non-forested ecosystem.

Item 7. Describe the most evident forest understory type.

Item 8. Landform classifications should be drawn from the hillslope components identified on page 49, Figure B-2-Hillslope components in profile, in *"Glossary of Landform and Geologic Terms for Land Classification and Characterizations."*

Item 9. Calculate in the office.

Item 10. Measurement taken from the campsite centerpoint to the edge of the closest maintained trail at its closest point. If the campsite is not reasonably close to the trail (further than the length of 2 measuring tapes, appr. 100m), measurement will be calculated in the office.

Complete screening when neither the trail or people on the trail can be seen from the impact site. **Partial screening** if the trail (or anyone on the trail) can be seen from anywhere within the impact site. **No screening** if the campsite is adjacent to or if there is no vegetation separating the campsite and the trail.

Item 11. Measurement taken from the campsite centerpoint to water at the closest point. If the water is obviously lower than normal, measurement should be taken from the "normal" water mark. If no source of water is found within 200 meters of the impact site, enter N/F.

Item 12. The amount of trash that can be put into a one gallon container. Large pieces of trash should be visualized as if they could be crushed and placed into the container. Express amounts of trash adding up to less than one gallon as decimals (e.g. .20 gallon). Comment on the type of trash found, noting large items that should be removed. If time and duties permit, trash should be bagged and packed out.

Item 13. Count the number of places with evident human waste and/or toilet paper within 50 m. of the campsite area. Note in the comment section if the smell of waste is noticeable. If time and duties permit, human waste sites should be buried.

Item 14. The distance should be measured (in meters) between the centerpoints of adjacent sites. In cases where this method is not practical (i.e. campsites more than 100 meters apart), the measurement will be calculated in the office. **Screening:** Same as "Distance to Trail".

Item 15. The length of shoreline where vegetation is absent or obviously disturbed by trampling must be determined for sites adjacent to water. Take measurements of the sections of shoreline where disturbance can be constantly defined (for example, where vegetation is dense and fragile).

Do not count areas of shoreline disturbance caused by natural processes (e.g. flooding, natural erosion). Measure the entire disturbed area (including sections that are not disturbed). Then measure sections which have no disturbance and subtract from the total. Judgment must be made by comparing the site to an undisturbed "control" shoreline located near the campsites to determine natural conditions.

If the area is naturally barren, (bedrock, for example), simply enter 1 m. for the width of the access path.

Item 16. Firering: Count the number of firerings on the site. It is a firering only if the ring of stones is there; if they have been scattered, it is a fire scar (item 23).

Constructed seat: elaborate seats which may have backs, arms, shaved flat logs, etc.

Game pole: pole used by hunters to hang game to keep out of reach from animals.

Fire rack: metal grate used for cooking.

Primitive seat: logs without sawed off ends, etc.

Other: list other elaborate facilities observed. (Do not include flat tent sites, unless there are trenched out areas.)

Item 17. Details about location of site, impacts, suggestions, uncertainties about measurements, etc.

IMPACT INDEX RATING (.er ONE category)

18. a. Vegetation Cover Onsite : 1=0-5%
2=6-25% 3=26-50% 4=51-75% 5=76-100% ___

b. Vegetation Cover Offsite : 1=0-5%
2=6-25% 3=26-50% 4=51-75% 5=76-100% ___

19. VEGETATION COVER (18b - 18a =___) 2 x ___ = ___

1. No difference in coverage
2. Difference one coverage class
3. Difference two or more coverage classes

20. a. Mineral Soil Exposure Onsite : 1=0-5%
2=6-25% 3=26-50% 4=51-75% 5=76-100% ___

b. Mineral Soil Exposure Offsite : 1=0-5%
2=6-25% 3=26-50% 4=51-75% 5=76-100% ___

21. MINERAL SOIL INCREASE (20a - 20b =___) 2 x ___ = ___

1. No difference in coverage
2. Difference of one coverage class
3. Difference of two or more coverage classes

22. TREE DAMAGE 2 x ___ = ___

Number of trees scarred or felled _____
1. No more than broken lower branches
2. 1-8 scarred trees, 1-3 badly scarred or felled
3. >8 scarred trees, >3 badly scarred

23. CLEANLINESS 1 x ___ = ___

Number of fire scars ____
1. No firering or scar
2. Charcoal from 1 firering or scar
3. More than 1 firering or scar, some litter
4. Human waste, or much litter,

24. ROOT EXPOSURE 2 x ___ = ___

Number of trees with roots exposed _____
1. None
2. 1-6 with roots exposed
3. >6 trees with roots exposed

25. DEVELOPMENT 1 x ___ = ___

1. No facilities
2. 1 firering with or without primitive log seat
3. >1 firering or other major development

26. SOCIAL TRAILS 2 x ___ = ___

Total number of trails ___
1. No discernible trail
2. 1 discernible trail, no well-worn trail
3. 2-3 discernible, max. 1 well-worn trail
4. >3 discernible or more than 1 well-worn trail

(Calculate in the office)

27. BARREN CORE CAMP AREA 3 x ___ = ___

Barren (X) Core Area: _____(sq. m.)
1. <4.6 sq. m.
2. 4.6-47 sq. m.
3. >47 sq. m.

(Calculate in the office)

28. CAMP AREA 3 x ___ = ___

Campsite (O) Area + Satellite Area _____ -
Island Area _____ = _____ (sq. m.)
1. <47 sq. m.
2. 47-186 sq. m.
3. >186 sq. m.

(Calculate in the office)

29. IMPACT INDEX

Items 18 - 19. Using the five coverage classes estimate the percent coverage of live understory vegetation. Count tree seedlings, saplings under 2" in diameter, and rhododendron as vegetation cover. Do not include dead vegetation, duff, and trees.

Item 18a. Make an estimate of vegetation cover for the entire campsite. With a large campsite, it may help to divide the site into equal quarters; estimate the percentage cover of each quarter and take the average. It may also help to visually cluster all vegetation into one part of the site and estimate what percentage of the site would be covered. Try to select one coverage class decisively. If not, choose best estimate and note the difficulties in the comment section.

Item 18b. Make the same estimate of vegetation cover on a nearly unused site similar - except for the impact - to the campsite. The idea here is to select a site that is similar to what the campsite probably looked like before it was used. Choose a site that is similar to the campsite in terms of rockiness, slope, aspect, overstory composition and cover, and understory species composition. Protected plants around the base of trees or rocks can provide hints about species composition.

Item 19. Using the information in items 18a and 18b, record the difference in vegetation cover class between campsite and comparative area. If there is no difference, enter rating 1, enter 2 if coverage one class less, enter 3 if the difference is greater than one coverage class.

Item 20a. Using the same five coverage classes, estimate the percentage of the campsite on which mineral soil is exposed, i.e. the percentage without live vegetation or duff. In many cases, a thin layer of disturbed needles, leaves, or wood chips is scattered about with mineral soil showing through. Consider these areas to be exposed soil.

Item 20b. Make the same estimate on the comparative area. In practice it will be easiest to estimate both vegetation cover and mineral soil exposure on the campsite, select the comparative area, and make the same estimates there.

Item 21. Using the information in items 20a and 20b, record the difference in mineral soil coverage between the campsite and comparative area. If there is no difference enter a rating of 1, enter 2 if coverage on the campsite is one class higher than on the comparative area, enter 3 if the difference is greater than one coverage class.

Item 22. Count the total number of damaged trees on the campsite and the area visible from the campsite. Never count the same tree on more than one site.

Damaged trees include stumps that show cut marks, trees with axe marks or lantern burns, and trees with nails in them. Bad scars are scars at least 1 sq. ft. [929 sq.cm.]). Do not include rhododendron damage.

Item 23. Count the number of fire scars, including any firerings as fire scars. Enter 1 if no fire scars, no litter, no human waste; 2 if one fire scar, very little litter, no human waste; 3 if more than one fire scar or if litter is evident; 4 if any human waste or much litter.

Item 24. Count the number of trees with exposed roots on the same area as for tree damage. Exposure should be pronounced, extending at least 1 ft. (0.3 m.) from the tree trunk. It should only be from the direct result of trampling. Do not include those trees which normally have shallow root systems (e.g. Eastern Hemlock and Yellow Birch), unless it can be determined that the exposure has been caused by trampling. Do not include rhododendron root exposure.

Item 25. Enter 1 if there are no facilities - not even a firering. A fire site is considered a ring only if the ring of stones is there; if they have been scattered, it is a fire scar (see item 23) but not a firering. If there is only one firering, primitive log seats (without sawed off ends), or both, enter 2. If there is more than one firering, or if there are any more elaborate facilities, such as constructed seats, shelves, toilets, and so forth, enter 3.

Item 26. Social trails are informal trails that lead from the site to water, the main trail, other campsites, or satellite sites. "**Discernible**" trails can seen, but do not contain exposed mineral soil. "**Well-worn**" trails are mostly devegetated. Count the total number of trails, regardless of whether they are discernible or well-worn. Enter 1 if there are no trails visible, 2 if there is only one discernible trail and no well-worn trails, 3 if there are two or three discernible trails or one well-worn trail, and 4 if there are more than three discernible trails or more than one well-worn trail.

Item 27. Calculate in the office. The campsite core is that area of the campsite which contains 25% or less vegetation coverage, is usually the center of the campsite, and where most of the impacts occur. Bare areas may or may not be covered with duff.

Item 28. Calculate in the office. Where there is no vegetation naturally and no other evidence of disturbance to identify the edge of the site, place an N/A in the estimated area space and enter 1. This may also be necessary on lightly used sites where little vegetation loss is evident.

Item 29. Calculate in the office.