



Ken Sturm/USFWS

Female chalk-fronted corporal

Environmental Consequences

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Introduction

This chapter describes the environmental consequences we predict from implementing the management alternatives presented in chapter 3. Where detailed information is available, we present a scientific and analytic comparison between alternatives and their anticipated consequences, which we describe as “impacts” or “effects.” In the absence of detailed information, we make comparisons based on our professional judgment and experience. We specifically predict the effects of implementing the management actions and strategies for each of the four alternatives: alternative A (Current Management), which serves as the baseline for comparing alternative B (Focal Species Emphasis: the Service-preferred alternative), alternative C (Emphasis on Expanding Priority Public Uses), and alternative D (Focus on Managing Historic Habitats).

Our discussion focuses on the impacts associated with the goals and issues identified in chapter 1 – Purpose of and Need for Action. Direct, indirect, short-term, beneficial and adverse effects likely to occur over the 15-year life span of the plan are discussed. Beyond the 15-year planning horizon, we give a more speculative description of the direct, indirect, and cumulative effects. At the end of this chapter, Table 4.12 summarizes the effects predicted for each alternative and allows for a side-by-side comparison. This chapter identifies the irreversible and irretrievable commitment of resources from our proposed actions. The relationship between short-term uses of the environment and long-term productivity of proposed actions, their cumulative effects, and the relationship to environmental justice are also described.

As required by Council on Environmental Quality (CEQ) and U.S. Fish and Wildlife Service (Service) regulations implementing the National Environmental Policy Act (NEPA), we assessed the importance of the effects of the Comprehensive Conservation Plan (CCP) alternatives based on their context and intensity. The context of the impacts ranges from local and site-specific to regional and broad-scale, for example, direct impacts to soils at a kiosk construction location would be highly localized. Impacts on Cheat Mountain salamanders would directly affect their populations in Canaan Valley and indirectly affect their populations in the larger context of their limited range and distribution. Improvements in breeding habitat for golden-winged warbler would benefit this species of conservation concern in the context of Bird Conservation Region (BCR) 28 and throughout its range. Although refuge lands comprise a small percentage of these larger ecosystem or regional contexts, all alternatives were developed to contribute towards conservation goals in these larger geographic landscapes. Table 4.1 provides some context for our discussion.

We evaluated the intensity of impacts based on the expected degree or percentage of resource change from current conditions, the frequency and duration of the effect, the sensitivity of the resource to such an effect or the natural resiliency of the resource to recover from such an effect, and the potential for implementing effective preventative or mitigation measures to reduce the effect. Duration of effects vary from those that would occur only once for a brief period of time during the 15-year planning horizon, for example, the effects of environmental education pavilion construction, to those that would occur every day during a given season of the year, for example, the effects of hunting and fishing.

Table 4.1. Impact contexts for Service actions under CCP at Canaan Valley Refuge

Area	Acres
Environmental Education Pavilion	0.06 acres
Spruce-fir Forest Units	215 acres
Research Natural Area	754 acres
Canaan Valley Refuge	16,183 acres
Tucker County, W.V.	269,440 acres (421 mi ²)
Partners in Flight (Landbird), Mid Atlantic Ridge and Valley Physiographic Region 12 – Spruce-fir Forest	90,439 acres (141 mi ²)
Appalachian Mountain Region – Bird Conservation Region 28	105 million acres (164,063 mi ²)

There are certain types of actions identified in chapter 3 that do not require additional NEPA analysis because they are “categorically excluded” (516 DM 2.3(A)) from further analysis or review. Categorical exclusions are classes of actions which do not individually or cumulatively have a significant effect on the human environment. These categorically excluded actions include, but are not limited to, the following actions, as listed in 516 DM 8.5A:

- Environmental education and interpretative programs (unless major construction is involved, or a significant increase in visitation is expected).
- Research, resource inventories, and other resource information collection activities.
- Operations and maintenance of existing infrastructure and facilities (unless major renovation is involved).
- Routine, recurring management activities and improvements.
- Small construction projects (e.g. fences, berms, small stream and wetland restoration projects, trail maintenance, interpretative kiosks, development of access for routine management purposes).
- Minor vegetation plantings.
- Reintroducing native plants and animals.
- Minor changes in amounts or types of public use.
- Issuance of new or revised management plans when only minor changes are planned.
- Law enforcement activities.

The ‘extraordinary circumstances’ in 43 C.F.R 46.215 are exceptions to our categorical exclusions discussed above. If any of these exceptions apply, we will conduct a further NEPA analysis of the proposed action.

Specifically, the proposed actions we plan to categorically exclude and that do not pose extraordinary circumstances are:

- Convert Camp 70/Delta 13 road to a trail for pedestrian, equestrian, and bicycle use, provided the refuge gains jurisdiction over this road.
- Construct a photo/observation blind along the trail at the end of A-Frame Rd.
- Improve already-existing boat launch sites.
- Renovate existing refuge offices to create a larger meeting space.

Actions that are not categorically excluded and that will require additional NEPA analysis above and beyond this draft CCP/EA are:

- Create new trails and trail connections.
- Construct a parking area, platform and interpretive kiosk where A-frame Road enters the refuge.
- Create new boat launch sites.
- Construct an environmental education pavilion on the Beall Trail in the vicinity of the Blackwater River.

We have organized this chapter by major resource heading. Under each heading we discuss the resource context and management actions that may affect the environment then benefits and adverse effects regardless of which alternative is selected, and finally the benefits and adverse effects of each of the alternatives. Effects on wildlife and plants are discussed within the “*Effects on Uplands Habitats*” and “*Effects on Freshwater Wetlands*” sections as anticipated effects to wildlife and plant species are interconnected with the refuge’s management actions in these habitat types. For more information on impacts relating to the refuge’s hunt program refer to the “Amended Environmental Assessment Hunt Program Proposal” (April 2007), and available on the planning website along with this document.

Effects on Air Quality

Chapter 2 – Affected Environment presents the status of air quality in the region of the refuge. Overall air quality is good, with no current criteria pollutants exceedances, but of recent concern is ground level ozone which has exceeded the Environmental Protection Agency (EPA) 8-hr standard (75 ppb) for safe health levels on 1-5 days per year from 1995 to present.

We evaluated the management actions the alternatives propose for their potential to help improve air quality locally, in the region, and globally. The benefits we considered included the

- potential to adopt energy efficient practices to reduce the refuge’s contribution to emissions and use the Service’s Strategic Plan for Responding to Climate Change (draft 2009)
- potential of refuge land acquisition and protection to limit the growth of development, thereby limiting emission sources and reducing losses of natural vegetation
- potential of refuge forest management activities, such as reforestation, to contribute to carbon sequestration and reduce greenhouse gases

The potential adverse air quality effects of the Canaan Valley management alternatives that we evaluated included increases in pollutants from

- setting prescribed fires to manage grasslands.
- applying herbicides to control invasive plants.
- blowing dust from construction sites, roads, and trails.
- increasing emissions from vehicles and equipment.



Gerald Vickers/USFWS

Prescribed burn

Air Quality Impacts That Would Not Vary by Alternative

Regardless of which management alternative our regional director selects, refuge management activities should not adversely affect regional air quality. None of the alternatives would violate EPA standards; all four would be in compliance with the Clean Air Act.

In Tucker County and surrounding counties there are a number of hazardous air pollution sources (EPA 2008), most notably Mount Storm Power Station in Grant County. Tucker County is in-attainment for criteria pollutants. No major stationary or mobile sources of air pollutants are present at the refuge, and our management would create none. On the contrary, the Service limits the uses of the refuge to compatible, wildlife-oriented, consumptive and non-consumptive uses, and thus, curtails anthropogenic sources of emissions by maintaining forested and non-forested wetlands, upland forests, grasslands, and early successional sites in natural vegetation cover. Therefore, in analyzing the impacts on air quality, we considered only how Service actions at the refuge might affect criteria air pollutants, visibility, and global warming to a minimal degree, focusing instead on the potential for localized air quality impacts or improvement.

None of the proposed management alternatives would affect visibility due to emission haze at the nearest Class I airsheds, Dolly Sods and Otter Creek wildernesses. Of particular concern is the Dolly Sods wilderness, which borders the refuge and has the potential to be directly affected by refuge construction and public use activities. In all the alternatives, the management actions would be short-term and localized and public uses of the refuge would contribute a negligible increment to the Tucker County air emission levels overall. Visibility at the Dolly Sods wilderness area would benefit from the protection of adjacent refuge lands which precludes development activities.

Wildfires are not a substantial concern at the refuge, because they occur infrequently, and the rapid local response quickly limits their extent. Although we would conduct prescribed burns to manage grassland and other habitat in alternatives A, B, and C and to possibly control invasive plants in all the alternatives, we would monitor and control the burning carefully to keep the risk of wildfire low.

In all the alternatives, we would use the herbicides approved by the Service such as, but not limited to, glyphosate to control invasive plants. Glyphosate is a non-volatile compound we would apply only with ground equipment, backpack sprayers, or hand-wicking individual plants, thereby virtually eliminating the likelihood of any measurable airborne particulates. Glyphosate is not a high risk to human or wildlife health, because of its low toxicity to vertebrates and strong affinity for soils that renders it biologically unavailable soon after application. Nevertheless, we will take all precautions with respect to wind conditions, time of day, and proper equipment to ensure that we expose only target plants to the chemical.

We will make responsible energy use fundamental in the development and operation of our lands and facilities, as well as in contractor and commercial visitor services. The energy management process will emphasize energy awareness, energy conservation, and energy efficiency, as well as the use of renewable energy resources, including bio-based fuels. We would introduce energy efficiency measures in our operations that would also reduce emissions. All motorized equipment would be upgraded to 4-stroke equipment whenever a current piece of equipment is retired. We would improve insulation in buildings, use radiant heat where feasible, and fluorescent lights where ever possible.

Impacts of Alternative A (Current Management)

Benefits

Proposed refuge management activities would neither substantively benefit nor adversely affect currently good local and regional air quality, with no violations of federal or state Clean Air Act standards, no impacts to nearby Class I areas, and no cumulative effects on regional ozone or particulate matter pollutant levels.

There would be minor air quality benefits from the air pollutant filtering effects of 16,183 acres of upland, riparian and wetlands vegetation and from adopting energy efficient practices. There would be a negligible reduction in atmospheric carbon due to the sequestering effects of 6,962 forested acres. Benefits would be limited to land purchases within the current refuge acquisition boundary.

Under alternative A, there would be minimal forest stand improvement and shrub management activities (i.e., alder/shrub and aspen cutting) that would involve removal of existing cover. The refuge will continue planting red spruce, balsam fir, and other native tree seedlings. While planting seedlings would increase beneficial effects from carbon sequestration, the extent of benefits is limited when compared to the other alternatives.

Adverse Impacts

Alternative A would include few ground disturbing activities and introduce few additional emission sources. Adverse impacts are the same as those discussed in *Impacts that would not vary by alternative*.

An increase of about 10 percent annual refuge visits by motor vehicle would cause a minor increase in air emissions in the long term and contribute minimally to potential cumulative effects.

Impacts of Alternative B (Focal Species Emphasis)

Benefits

The effects of alternative B would be similar to alternative A. Locally there would be more minor benefits in comparison to alternative A but also more potential adverse effects.

Air quality benefits would increase from maintaining up to 16,183 acres of natural vegetation on existing refuge lands to filter air and from more energy efficient refuge operations. Acquiring additional forested acres within the acquisition boundary would stem nearby development growth and reduce potential air emissions from homes, businesses, camps, vehicles, off-road vehicles and equipment.

We would institute a forest management plan that focuses on forest restoration, improvement and enlargement of red spruce, balsam fir, and northern hardwood stands so that carbon sequestration benefits would increase. Increasing the extent of forest stands would improve the health, diversity, and resilience of the forest to disturbance, disease, and insect outbreaks, thus maintaining an important carbon “sink.”

Adverse Impacts

A 15 percent projected increase in annual refuge visits would increase vehicle emissions on and near the refuge in the longer term. Vehicle emissions would be expected to increase with the addition of a limited shuttle service to facilitate the harvest of white-tailed deer in remote locations on the refuge.

New trail, infrastructure, and parking lot construction (see text box) would cause short-term, localized effects from dust and from the exhaust of construction vehicles and other equipment. The operation of the refuge headquarters and other facilities would continue to contribute slightly to the ambient levels of local, stationary source emissions.

Table 4.2. Alternative B Proposed Construction Projects

1. Connect Beall trails to Middle Valley Trail, Brown Mountain Overlook to Camp 70 Loop Trail, and Swinging bridge trail to Cortland Road
2. Construct an observation platform along A-Frame Road on the refuge.
3. Construct an environmental education pavilion and storage room on the Beall Tract.
4. Construct larger meeting room near visitor center or re-allocate space within headquarters facility.

Impacts of Alternative C (Maximize Public Use)

Benefits

Alternative C would have similar beneficial impacts as described in alternative B.

Adverse Impacts

Alternative C would have similar adverse impacts as described in alternative B. There would be an increase in localized, short-term impacts from additional construction (see text box).

Table 4.3. Alternative C Proposed Construction Projects

In addition to Alternative B Proposed Construction Projects:
Design and install an observation platform at the end of the developed road on Camp 70.
Create a cross valley trail by connecting Brown Mountain Overlook trail to A-Frame Road.
Reconstruct Delta 13/Camp 70 Road if WV Department of Transportation abandons it and construct a new parking lot.

Impacts of Alternative D (Focus on Managing for Historical Habitat)

Benefits

Alternative D would provide increased long-term benefits to air quality when compared with the other alternatives. Over the long-term (50+ years) the predominance of more mature stands would improve the health, diversity, and resilience of the forest to disturbance, disease, and insect outbreaks, thus maintaining an important carbon “sink.” Additionally, trail closures would concentrate visitor use and provide opportunities for the refuge to restore native forest plant communities providing long-term benefits to local air quality.

We would not burn any prescribed fires for grassland management, but would allow the refuge grasslands to succeed to scrub-shrub and forested habitat.

Adverse Impacts

Vehicle emissions would be similar to those discussed in alternative A. Adverse impacts from visitor infrastructure construction projects are the same as those discussed in alternative B.

Effects on Hydrology and Water Quality

Management actions proposed for the refuge’s CCP alternatives were evaluated and compared based on their potential to help maintain and improve the hydrology and water quality of the wetlands, rivers, ponds, and vernal pools in the Blackwater River watershed. We evaluated the benefits of actions that would protect or restore the hydrology or maintain or improve water quality including:

- Land acquisition and conservation that would provide watershed benefits by limiting land clearing and changes in local hydrology.
- Habitat restoration through logging/skid road removal that would reduce erosion and restore site hydrology.
- Wetland restoration projects.
- Improvements in local hydrology through road/trail reconstruction or removal and culvert removal, replacement, or installation.
- Improved water quality monitoring for early problem identification.
- Improved cooperation of other landowners in watershed to influence water quality.
- Establishing a Research Natural Area (RNA) to preserve examples of major wetland ecosystem types, provide research and educational opportunities for scientists and others; and contribute to the preservation of genetic and behavioral diversity for native plants and animals.

We evaluated and compared the impacts of refuge management actions with the potential to cause adverse effects to hydrology and water quality including:

- Use of herbicides to manage invasive species.
- Refuge construction projects.
- Changes in recreational use that might lead to increased siltation into refuge waterways and petroleum product contamination.

Impacts That Would Not Vary by Alternative

Regardless of which alternative we select, we would take a number of steps to ensure that we have sufficient scientific data to support management decisions regarding refuge hydrology and water quality.

Benefits

We would expect an increase in hydrology and water quality benefits from continued protection and restoration of refuge lands. Acquisition and conservation of more than 8,932 additional acres of upland forest, wetlands, and other lands within the acquisition boundary would further benefit water resources because acquisition would increase watershed protection to ensure the integrity of wetland habitats in Canaan Valley.



Ken Sturm/USFWS

Big Cove beaver pond

Service actions at the refuge would not affect pollution levels from point and nonpoint sources. However, the refuge will continue to benefit water quality in the Blackwater River watershed by limiting development in that part of the watershed and acting as a buffer against non-point-source pollution in the surrounding landscape. The existing and restored wetlands adjacent to the river will filter water moving into the river and help improve water quality.

Stringent precautions in conducting refuge management activities would prevent chemical contamination of water directly through leaks or spills or indirectly through soil runoff.

Adverse Impacts

In managing the refuge, we would closely monitor and mitigate all of our routine activities that have some potential to result in chemical contamination of water directly through leakage or spills or indirectly through soil runoff. These include control of weeds and insects around structures, use of chemicals for de-icing walkways, and use of soaps and detergents for cleaning vehicles and equipment. Personnel would take the following precautions to minimize the potential for the chemicals and petroleum products becoming a water quality problem:

- Pouring or mixing of chemicals or petroleum products would be conducted no closer than 100 feet from surface water and over a non-porous surface material.
- All staff would be trained in spill prevention and spill response.
- All vehicle and equipment cleaning would be performed at the existing shop wash pad to filter run off.
- All applicators would be state certified.

Invasive plant control with herbicides - The herbicides selected are reviewed by the Regional Contaminants Specialist who is responsible for upholding federal standards for water quality and soil protection. Only those chemicals approved by the Service will be used. It is also acknowledged that reducing our dependency on chemical pesticides is unquestionably the best thing to do for protecting refuge resources. A common herbicide used by the refuge currently includes the active ingredient glyphosate, formulated as Rodeo®, used to prevent establishment and spread of invasive plants, in particular, reed canary grass, multiflora rose, yellow flag iris, and cattails.

Some potential exists for the concentration of herbicides to build up over time in river sediments, lakes, ponds, and wetland habitats. The potential depends on the balance of pesticide input and removal from the lake or pond system. Herbicide inputs may occur either through direct application, water inflow, or through re-suspension and diffusion from the sediment layer. Herbicide removal from the system may occur through outflow, degradation, volatilization, and settling or diffusion into the underlying sediment (Neitsch et al. 2001).

The rate of herbicide degradation is an important consideration for assessing the effects of any herbicide on aquatic systems. Glyphosate degrades with a reported half-life in water from 3.5 to 70 days, depending on the rate of transfer to the sediment layer and testing source (SERA 1996). Based on its relatively short half-life and the large water volume of the river and wetlands, and the limited acreage likely to require treatment, it is not expected that any discernible effects would occur to these water resources as a result of herbicide treatments.

Impacts from increased visitation- All alternatives predict some increase in annual visitor numbers; however, the increase may vary due to increased public use opportunities that vary among the alternatives. Alternatives A and D predict the lowest annual increase, while alternatives B and C predict the highest increase in response to increasing public use opportunities, with alternative C providing the maximum public use of all the alternatives.

Impacts of Alternative A (Current Management)

Benefits

Benefits to hydrology and water quality under alternative A are the same as those discussed in *Impacts that would not vary by alternative*

Adverse Impacts

Restoration and management activities on the refuge would be limited thus minimizing short-term impacts to hydrology and water quality. However, long-term adverse impacts to rivers and streams would be expected from further degradation of impacted riparian areas, which are not slated for restoration under current management of the refuge. In areas where restoration will occur, like shrubland restoration on the Thompson tract, the refuge will follow best management practices to minimize adverse impacts to hydrology and water quality. Restoration activities on the Thompson tract are not likely to impact hydrology and water quality as the refuge will use a combination of hand plantings and natural growth to achieve shrubland characteristics. Based on restoration methods, it is unlikely water in adjacent drainage ditches would be adversely impacted from soil loss.

Under alternative A, the risk of herbicide contamination, used in invasive plant control, to open water and wetland habitats would be minimal. Managing invasive species at current levels has not necessitated widespread application of herbicides adjacent to hydrologic resources. We would mitigate any potential risk by properly applying the herbicide. Currently glyphosate based herbicides are the primary chemicals used for refuge management operations. In some formulations, such as the one in the brand-name formula Rodeo®, glyphosate is

not a problem aquatic contaminant, because it does not contain the toxic adjuvant found in other formulations, such as in the brand-name formula Roundup. Also, it quickly adsorbs to suspended soil particles in water, rapidly making it biologically unavailable.

In alternative A, fishing and hunting as well as non-consumptive uses, including hiking, biking, horseback riding, wildlife photography, canoeing, and kayaking, would increase by 10 percent. That presents an increased potential for the contamination of the Blackwater River and its tributaries through the soil sedimentation from hiking, biking, horseback riding, canoeing, and kayaking into streams and runoff of petroleum products from parking lots. The refuge would provide two unimproved boat launch sites, which would benefit streambanks as a whole by concentrating use to specific locations; however, adverse impacts would likely be observed at these sites relating to streambank erosion and siltation. Adverse impacts to hydrology and water quality from visitor use are minimized, in comparison to the other alternatives, because visitor use is limited to designated roads and trails throughout the year. However alternative A is the only alternative in which we would not seek to gain jurisdiction over Camp 70/Delta Road and improve the condition of that road. Without improvements to that road, public use will continue to degrade the road, causing severe erosion and siltation.

We would continue to permit limited off trail use by non-hunters through issuance of special use permits (SUPs). Because there are so few people who request SUPs for off-trail use, impacts have been negligible. We do not anticipate an increase in requests and therefore we predict that there will continue to be negligible impacts.

The refuge minimizes impacts to water resources by routinely monitoring roads and trails for damage and by remediating problem areas. An increase in recreational boating activities might lead to river and stream contamination. Public outreach would increase awareness of issues such as invasive aquatic plants, introduction of invasive fish, and lead contamination. Thus, outreach would help to mitigate risks associated with visitor use of waterways on the refuge.

Impacts of Alternative B (Focal Species Emphasis)

Benefits

Hydrologic processes will be restored to impacted wetlands and former rail grades and trails that bisect wetland complexes through sectional removal, culvert placement, permeable fill or other methods as appropriate. Restoration and remediation efforts would have short-term adverse effects caused by soil erosion and sedimentation. However, once completed, these areas would provide long-term benefits to wetland complexes by restoration of surface and subsurface flow through contiguous wetland complexes. Additionally, wetlands and associated rivers and streams in Canaan Valley would benefit from the designation of a 754 acre RNA, composed of 93% wetlands and 7% uplands, by limiting human intervention and preserving wetland plant communities and plant species that are vanishing, rare, or restricted within their range. These areas will also benefit if the refuge is able to gain jurisdiction over Camp 70/Delta Road. If the refuge owned this road it would be able to stabilize the road and eliminate vehicle access so as to prevent further erosion and siltation.

In upland forested areas on the refuge, habitat restoration of former logging roads and skid trails would create short-term adverse impacts from soil erosion and sedimentation downstream. However, the short-term impacts do not outweigh the long-term benefits related to increasing forested blocks by reducing forest fragmentation. Logging road obliteration would improve downstream

erosion and siltation by removing improperly placed culverts. Planting native seedlings and annual grasses would stabilize soils and prevent downstream turbidity.

Under alternative B, launch sites for canoes, kayaks, and other hand-launched boats would be improved to minimize risks of streambank erosion and siltation into refuge waterways.

Adverse Impacts

New trails, infrastructure (see Air Quality Effects from Alternative B, Table 4.2, for a list of construction projects), observation platform along A-Frame Road, Environmental Education Pavilion, and parking lot construction would cause short-term adverse impacts from soil runoff and sedimentation into the refuge's water resources. There would be additional impacts to water resources where new trails cross the refuge's rivers, streams, and tributaries increasing the potential short-term and long-term downstream erosion and sedimentation. However, the refuge will adhere to best management practices for construction to minimize adverse impacts to hydrology and water quality. Increased visitor infrastructure represents an increase over alternative A in the potential for contaminating rivers, streams, and open water through the runoff of petroleum products from parking lots. In addition, a refuge shuttle service to facilitate deer removal along Middle Ridge would increase the potential for soil sedimentation and streambank erosion into Glade and/or Sand Run. The refuge would minimize adverse impacts by limiting the shuttle service to vehicles driven by refuge staff during the first three days of deer-gun season and stabilizing stream crossings to limit sedimentation and erosion.

The construction of a boardwalk to connect Camp 70 Road to the Brown Mountain Overlook trail will create short-term direct impacts to hydrology and water quality through trail construction. No construction other than placement of boardwalk pilings would be done in wetlands so there would be short-term localized effects to hydrology and water quality during construction. By providing a path for users to cross over the wetlands and not through them, long-term effects to hydrology and water quality will be minimized.

Under alternative B, visitor use would increase by 15 percent from increasing opportunities related to wildlife observation and photography, in comparison to alternative A, in part because we will be increasing trail miles on the refuge. The refuge would minimize impacts to water resources from designated trails by monitoring and remediating impacted sites.



Mary Konchar

Wildlife photography

**Impacts of Alternative C
(Maximize Public Use)**

Benefits

Benefits to refuge water resources are similar to alternative B although benefits would be lessened by increased public use and construction activities. In addition, benefits to wetlands would occur from the designation of an RNA. Overall benefits would lessen, in comparison to alternative B, as only 593 acres, composed of 92% wetlands and 8% uplands, would be included in the RNA.

Adverse Impacts

There would be an increase in short-term impacts from additional construction activities (Table 4.3) like constructing an additional observation platform on Camp 70 Road and providing additional trails and trail connectivity. In comparison to alternative B, alternative C would provide additional opportunities for public use, which would increase the potential for soil compaction, runoff, and sedimentation. In areas where public use is concentrated the impacts would likely become more severe over time (Green 2008). Increased vehicle access on Camp 70 Road for wildlife observation and photography would increase the potential for contaminant and roadway runoff to affect adjacent wetlands and waterways.

The improvement of Camp 70 Road for increased vehicle access, whether the entire or part of the road's length, is unlikely to cause long-term adverse impacts to hydrology and water quality. Short-term adverse impacts would be minimal because the road is well established and the entire road length is within highly modified upland soils. As a part of road construction, the refuge would improve the road to minimize current impacts to water quality from erosion and siltation associated with one stream crossing, vernal pools within the road, and adjacent vernal pools. In its unimproved state, vernal pools are present on a portion of Camp 70 Road and habitat for wood frogs, American toads, and spotted salamanders would be lost with road improvement. The refuge has monitored these vernal pools since 2002 and has noted varying levels of disturbance and siltation from trail use that impacts wood frog and spotted salamander productivity. The refuge will evaluate constructing vernal pools in areas that would not be directly impacted from disturbance (e.g. bicycle wheel tracks, horse hoof prints).

The construction of the cross-valley trail that connects Brown Mountain Overlook Trail to A-Frame Road would create short-term adverse impacts to hydrology and water quality from trail construction. The cross-valley trail would utilize an existing railroad grade for a portion of its extent minimizing impacts to nearby wetlands and water resources. The refuge would construct a boardwalk in areas where hydrology and water quality would be affected by at-grade foot traffic and a bridge over the Little Blackwater River to minimize erosion of riverbanks. Adding this infrastructure is preferable because it will minimize long-term adverse impacts to hydrology and water quality.

In alternative C we would allow off-trail use in a zoned 2,330-acre area by special use permit only, for pedestrian, cross country skiing, and snowshoeing access. This access would be permitted only on Sundays during the hunting season. We would issue a maximum of 25 SUPs per month. Off-trail use would likely adversely impact Glade Run, Sand Run, the Blackwater River, and their tributaries. The refuge would minimize adverse impacts by limiting use to a time of year when many plants and animals are dormant or not present, and when the same or similar impacts would occur from hunting. However, visitor impacts would differ from hunting impacts as visitors are more likely to seek out views of streams and rivers, increasing the probability of adverse impacts to the refuge's water resources. In an effort to offset these adverse impacts the refuge is limiting off-trail use by zoning it for a particular area and a particular time of year. By issuing special use permits the refuge would be able

to gather information on the number of users, the days and duration of use, and approximate location of use. This information would enable the refuge to monitor known locations of off-trail use for damage and perform remediation measures as needed. For additional information on the impacts related to the off-trail use zone see *“Effects of Public Use and Access, Public Use and Access Impacts from Alternative C.”*

Under alternative C, we would increase staffing and engage in a higher level of routine refuge management activities that may result in a somewhat higher potential for chemical contamination of water directly through leakage or spills, or indirectly through soil runoff, than alternative A. We would follow the same measures outlined under alternative A to minimize these effects.

Impacts of Alternative D (Focus on Managing for Historical Habitat)

Benefits

Alternative D would likely provide greater long-term benefits for water quality than either alternative A, B, or C. We would promote a more natural hydrologic regime, would monitor to determine if this causes adverse water quality effects, and would alter management accordingly. We would manage all refuge lands to achieve a mature forest cover and natural hydrologic regime similar to the environment that existed at Canaan Valley pre-settlement. This canopy of upland and wetland forest would be highly protective of the refuge soils. We would not burn to maintain grassland habitat types so there would be no short-term impacts from particulate matter. In addition, we would restore the hydrology of Beall, Freeland, and Harper tracts by plugging ditches and re-contouring the wetland areas, which would result in short-term adverse impacts.

Benefits from a designated RNA are the same as discussed in Hydrology and Water Quality Impacts of Alternative B.

Adverse Impacts

Under alternative D, adverse impacts from construction activities and refuge shuttle service would be similar to alternative B. In addition, impacts related to visitor use are expected to be less under alternative D in comparison to alternatives B and C. While trail closures would beneficially impact hydrology and water quality associated with those areas, trail closures would also concentrate use on designated trails potentially increasing impacts to water resources. In addition, off-trail access would be the same as in alternative A, which increases beneficial impacts to hydrology and water quality in comparison to alternative C.

We would continue to control invasive plants with herbicides, which would have some minimal potential to affect water quality as discussed in Impacts that would not vary by alternative. However, we would no longer use prescribed burning as a tool for grassland management, therefore eliminating the possibility of burned particulate matter creating short-term reductions in water quality.

Effects on Soils

Soils are the structural matrix and nutrient source for plant productivity at the refuge and must be protected to sustain the variety of wetland, riparian, and upland habitats that would meet our habitat and species management goals. Overall, the soils of the refuge are productive and in good condition, with no substantive erosion, compaction, or contamination problems. In certain areas such as where Mauch Chunk-derived soils have been exposed from land use prior to refuge acquisition, we would manage these to limit any human disturbance and work to reduce erosion through restoration and soil stabilization practices.

We evaluated and compared the management actions proposed for each of the refuge CCP alternatives on the basis of their potential to benefit or adversely affect upland soils and soils of the refuge's floodplains, pond and lake shorelines, and riparian areas. Impacts of the alternatives to wetland soils are discussed in the wetlands section.

We compared the benefits of the alternatives from actions that would protect soils from erosion, compaction, or contamination or that would restore eroded, compacted, or contaminated soils, including the:

- Protection of refuge lands from development.
- Habitat restoration on former access roads, old railroad grades, logging roads, and trails to provide opportunities to restore soils.
- Remediation of impacted wetlands.

The potential adverse soil effects of the refuge management alternatives that were evaluated included impacts from:

- construction of buildings, observation platforms, parking lots, access roads, and interpretive trails;
- removal of unnecessary structures including old hunting cabins, barns, and hunting platform structures;
- forest and early-succession management activities, including tree-cutting and mowing, possible grazing and use of roads and skid trails;
- hiking, biking, horseback riding, or other refuge visitor activities;
- wildland fire suppression policies and methods; and
- providing refuge visitor activities and hunt programs.

Impacts That Would Not Vary by Alternative

Benefits

Soil stability has improved since refuge acquisition due to the prohibition of all vehicles from sensitive habitats and allowing vehicle access only on designated roads. We will continue to maintain native vegetative cover on the refuge that minimizes soil losses through erosion. All the land the Service now owns or would purchase within the refuge acquisition boundary would remain under Service management, thereby eliminating the potential for the soil impacts of development or other use. We will continue to prohibit recreational activities such as all-terrain vehicles (ATVs) that would damage soils on the refuge. Public use trails, boat launch sites, wildlife observation areas, parking lots, and other high-use areas would be well designed and maintained to keep impacts on the soil to a minimum. We will note and correct any erosion problems during routine refuge monitoring.

Regardless of which CCP alternative we select, we will continue to use best management practices in all activities that might affect refuge soils to ensure that we maintain soil productivity.

Adverse Impacts

Adverse impacts to soils would likely occur from restoration activities, habitat management for focal species, invasive species control, refuge infrastructure construction, and activities related to wildlife observation and photography.

Restoration Activities—Replanting may cause the short-term disturbance, compaction, and localized erosion of soil, depending on site conditions and methods of site preparation. The use of best management practices would minimize those effects. In the long-term, reestablishing native species would help restore and maintain soil productivity at those sites.

Prescribed Fire—We would reserve the options to use prescribed fire in all alternatives for controlling invasive plants if necessary and, in alternatives A, B, and C for managing grasslands as well. We would conduct all prescribed burns under a strict prescription and in optimal weather conditions to minimize concerns about smoke and the risk of wildfire. We would maintain all fires within their prescriptions to minimize the degradation of resources, although impacts could occur in small areas.

Prescribed fire elevates surface temperatures; mineralizes detritus, litter, and standing dead material; volatilizes some nutrients and organic matter; alters the water-holding capacity of soil; and alters its populations of micro- and macro-fauna (Barbour et al. 1999).

The effects on organic matter depend on the intensity and duration of the fire. Intense, long-duration fires consume more organic matter than brief, low intensity fires. Nitrogen compounds volatilize and are lost at temperatures of 100–200°C; in contrast, calcium, sodium, and magnesium usually are deposited on the soil surface and recycled. At temperatures of 200–300°C, large amounts of organic substances are lost, which can reduce the cation exchange and moisture holding capacity of soils.

Fire usually elevates soil pH, because of cation release; that effect is particularly evident in acidic soils. Fire may enhance soil microbial nitrogen fixation, due to the mineralization of nutrients and elevated pH levels in soils (Barbour et al. 1999).

The removal of litter and duff may initially facilitate water infiltration; nevertheless, the loss of litter and blackened soils also mediate evaporation. That results in an overall reduction in the water-holding capacity of soil. There is little change in water repellency with cool fires (below 176°C); moderately hot fires increase water repellence (176–204°C). Extremely hot fires (above 204°C) volatilize hydrophobic substances and destroy soil water repellence (Debano et al. 1998). After moderately intense fires, runoff may increase due to lowered infiltration, and erosion may result.

Fire usually reduces fungi, but increase soil bacteria. It may remove soil and litter pathogens. Fire often destroys nitrifying bacteria. Legumes and other nitrogen-fixing plants often must recover nitrogen losses due to volatilization, as the recovery of nitrifying bacteria is slow (Barbour et al. 1999).

We will burn small-scale prescribed fires on confined areas, in short durations and low to moderate intensities. Such fires also consume only part of the duff/litter layer, and rarely transfer major amounts of heat into the soils. We would use prescribed fires to remove litter and light fuels and avoid adverse effects of severe, hot wildfires on soil resources.

Considering all the potential methods of treatment, we expect negligible direct or indirect impacts on upland soils, as the effects are limited due to short duration and low to moderate intensity, and confined to the project area. We expect none of the proposed actions to affect adversely the soils or water quality over the long-term.



*Mowing Thompson Tract
with Batwing Mower*

Haying and Mowing—Depending on the soil conditions and vegetative ground cover, haying and mowing can affect soils through rutting and compaction, and through the removal of soil protective vegetation. Tracked equipment is not used in haying and mowing operations, and the operations are not done when the soil is saturated. In addition, haying and mowing would be conducted on a rotational basis typically of 3-4 years to maintain grassland habitat while minimizing any soil impacts. Since haying will primarily occur in dry grassland areas, impacts to wetlands and reptiles and amphibians will be minimal. This activity poses little additional impact to current grassland management actions by refuge personnel.

Invasive Plant Control with Herbicides—In all the alternatives, we would use herbicides approved by the Service to control invasive plants. While the refuge would consider using various Service approved herbicides, based on current use the refuge expects to use the herbicide glyphosate, formulated as Roundup® or Rodeo®, most commonly. As such, the refuge is focusing its discussion on impacts of glyphosate.

Glyphosate would not adversely affect the soils at the sites. Studies have shown that once Roundup reaches the soil, it strongly adsorbs to soil particles. With its half-life of 3.5 to 70 days, glyphosate degrades readily in soil (Weber 1991). Field and field simulation studies on glyphosate found no direct effect on basal soil respiration, microbial activity, or microbial biomass when glyphosate was applied at a rate of 5 kg/ha (SERA 1996), which is three times greater than the application rate proposed for treating invasive species on open land at the refuge. Therefore, no impact on soils would result from the application of glyphosate to wildlife habitat or ecological restoration sites.

Applications of glyphosate according to label directions for the use of Roundup, Accord®, and Rodeo herbicides do not have a negative impact upon microflora. Experiments on glyphosate-treated and untreated soils revealed no major difference in their microbial population or types or the degradation of sucrose (Rueppel et al. 1977). The degradation of cellulose, starch, protein, and leaf litter in soils treated with glyphosate was essentially the same as that in untreated soils. Studies also found that soil residues of glyphosate did not affect nitrogen fixation and nitrification.

The presence of glyphosate is unlikely to affect the beneficial mycorrhizal fungi, which help plants absorb water and nutrients, because the herbicide binds tightly to soil particles and is not available for uptake. The weight of evidence from several studies (Monsanto 2002) shows that actual use rates do not produce concentrations that would adversely affect fungi.

Earthworms are important components of ecosystems, and a favored food of American woodcock, one of the refuge's focal species. The impact of agricultural practices on earthworms has been extensively reviewed by other scientific, ecological, and agricultural organizations. In the *Biology and Ecology of Earthworms* (1996), Edwards and Bohlen examine the effect of many agricultural products on earthworms. The authors rank products using a scale of zero

(relatively non-toxic) to three (extremely toxic). Glyphosate ranks zero. The manufacturer, Monsanto, indicated that it has conducted several studies, which demonstrate that glyphosate and Roundup® herbicide are harmless to earthworms at concentrations greatly exceeding what the normal application of the product would produce. There was no mortality at the highest test concentration of 5,000 parts per million (ppm). No adverse effect of any kind was seen with a Roundup concentration of 500 ppm. Concentrations in the soil immediately after application depend on the amount of material intercepted by target plant material, and are typically less than 1 ppm.

Wildlife Observation and Photography—Trail use on the refuge would adversely impact soils through compaction, erosion, and sedimentation. In all alternatives, the refuge will allow hiking, biking, and horseback riding on designated trails.

Hiking—Soils can be compacted and eroded as a result of continued use of pedestrian routes. The Mauch Chunk-derived soil in Canaan Valley is particularly vulnerable to mechanical erosion when the vegetation has been removed (Rizzo 2002). If compacted, Mauch Chunk soils can facilitate rapid water runoff that accelerates erosion down slope (Rizzo 2002). Although it is unlikely foot travel would create highly erosive conditions, lug soles on hiking boots can exacerbate the problem.

Bicycles—Bicycle wheels can cause physical impacts to soil surfaces. Cessford (1995) notes the shearing action of wheels creates damage to roads and trails, which increases when trail conditions are wet or when traveling up a steep slope. When traveling down slope, skidding with hard braking can result in loosening soil surfaces, which leads to rutting and erosion by channeling water down wheel ruts. The Mauch Chunk-derived soil would be particularly susceptible to mechanical erosion that may occur when bicycle wheels skid or spin over the soil surface.

Horseback Riding—Horses would cause adverse impacts to soils when soils are wet which can directly affect plant growth and survival (Kuss 1986). Horseback riding has caused braided roads and trails in excessively muddy trail sections (Summer 1986). Weaver and Dale (1978) found horse use caused a greater loss of vegetation cover, wider and deeper roads and trails, and greater soil compaction when compared to hiker use on meadow and forest trail conditions. Horses may cause trail erosion by loosening the soil and increasing soil particle detachment under both wet and dry trail conditions (Deluca et al. 1998). While horse use would increase the impacts to soils through compaction and erosion, the refuge has attempted to minimize those impacts by only allowing horseback riding on roads open for vehicle use and trails modified through grading and with proper drainage located predominantly on upland soils. There are trail sections where Mauch Chunk-derived soils, which have high erosion and compaction potentials, have been exposed through activities that occurred prior to refuge acquisition. The refuge would monitor trails to ensure that damage is not occurring and would take actions to remediate the trail(s) to improve soil conditions. Examples of remediation measures the refuge might take include: recontouring, revegetating, and restoring or creating proper drainage patterns to degraded trails.

The refuge will minimize adverse impacts by using its trail/route checklist to determine whether the existing or new trail meets established criteria and addresses impacts to soil compaction potential, erodibility, and suitability. If it does not meet the checklist criteria, appropriate modifications will be made to trail routes either by locating a more suitable site or adding infrastructure to minimize short-term, localized, and long-term impacts to soils.

Damage from Fire—Soil damage from fires or from erosion on fire-damaged sites is unlikely to occur on the refuge. Wildland fires are suppressed when fire fighter and public safety are at risk. Although wildland fires rarely occur in the Canaan Valley area, we will protect against wildland fire whenever it threatens human life, property, and natural or cultural resources. Fires will be suppressed in a prompt, safe, aggressive, and cost effective manner to minimize adverse impacts to resources and acreage. Suppression methods will be chosen which cause minimum resource damage while accomplishing effective incident stabilization. For more information on the refuge's objectives and strategies in regards to prescribed and wild fires refer to the Fire Management Plan (2004).

Regardless of alternative, site conditions including soil condition, elevation, slope, aspect, and hydrology would be the ultimate determinant of the habitat management potential for any particular site on the refuge. No site would be managed in a manner inconsistent with its recognized potential.

Impacts of Alternative A (Current Management)

Benefits

Benefits to soils under alternative A are the same as those discussed in *Impacts that would not vary by alternative*.

Adverse Impacts

The refuge would be most constrained under alternative A in terms of implementing methods to reduce soil loss from wetland areas impacted by erosion and sedimentation. Our management efforts would be limited to habitat inventory, mapping, and monitoring of impacted wetland areas and soil loss but remediation would be minimal in these areas. In areas where restoration will occur, like shrubland restoration on the Thompson tract, the refuge will follow best management practices to minimize adverse impacts to soils. Short-term localized adverse impacts to soils would be expected where the refuge will hand-plant native shrubs to enhance natural growth. Based on restoration methods, soil compaction and loss would be minimal.

Over the long-term, the risk of erosion and sedimentation problems that might affect these habitats would increase with increased visitor usage and trail use. At current levels the trail system supports hiking, biking, and horseback riding and each trail is designated for the uses its soil types are capable of supporting. Wetland complexes adjacent to active trails, like the Middle Valley trail and South Glade Run Crossing trail, would be of particular concern as degradation from hiking, biking, and horseback riding would increase the potential for soil compaction, erosion, and sedimentation into adjacent wetlands and stream. Although off-trail use is allowed by special use permit, there are currently not enough off-trail users to cause any impacts, and we would do not expect the user level to change in the next 15 years.

Impacts of Alternative B (Focal Species Emphasis)

Benefits

Benefits to soils would likely increase in alternative B, in contrast to alternative A through the remediation of impacted wetland areas and recontouring and reforestation of old logging/skid roads and trails. We would apply best management practices to restore any sites with eroded soils and protect the soil with an appropriate native plant cover.

The refuge will construct a boardwalk connecting Camp 70 Loop trail to Brown Mountain Overlook trail over saturated areas to protect sensitive wetland soils from compaction. No construction other than placement of boardwalk pilings would be done in wetlands so there should be negligible, localized effects to wetland soils. The boardwalk would provide long-term benefits by providing a

means for visitors to cross over these sensitive wetland soils without walking through them.

Adverse Impacts

Under the expanded construction program noted in the section on Air Quality, there would be localized soil compaction and loss of productive soil where soils are removed or surfaced for observation platforms, environmental education pavilion, parking lots, kiosks, boat launches, roads, and trails and in adjacent areas where vehicles and heavy equipment are used for site access and preparation work. These impacts would constitute unavoidable adverse impacts from refuge infrastructure improvements but would comprise, in total, only a small percentage of the 16,183 acres within the current refuge boundary. In addition, a refuge shuttle service to facilitate deer removal along Middle Ridge would increase the potential for soil sedimentation and streambank erosion into Glade and/or Sand Run. The refuge would minimize adverse impacts by limiting the shuttle service to vehicles driven by refuge staff during the first few days of deer-gun season and stabilizing stream crossings to limit sedimentation and erosion. Offsetting these soil impacts would be reclamation of natural soil productivity on restored wetlands and uplands, and obliteration, recontouring, and revegetating old logging roads and trails on the refuge.

Restoration activities—There would be short-term, localized soil disturbance, compaction, and erosion from restoration activities where stand cutting and clearing in upland and wetland forests, and where construction of white-tailed deer exclosures are implemented to protect rare and sensitive plants from white-tailed deer over-browse. We would minimize these impacts by adhering strictly to best management practices for our forest management operations.

Successional Management—We would evaluate the techniques to perform successional habitat management based on the best management practices to achieve vegetation objectives. Cutting may be completed using tracked vehicles which could compact soils during management operations. Potential use of grazing animals may also compact soils and cause localized erosion. We would conduct cutting operations with heavy equipment in upland areas and utilize existing skid roads when possible to avoid excessive soil compaction and erosion. Cutting during winter months when soils are frozen is also an option to reduce the impact. Limiting the area grazing animals are permitted within and the duration of their stay will help prevent excessive soil compaction and erosion. Fencing will ensure animals remain within the desired management unit.

Wildlife Observation and Photography—Adverse impacts to soils would increase in alternative B in comparison to alternative A, with an increase in the number of trails, trail miles, and increased estimated visitor use. Construction and maintenance of trails would result in short-term and long-term adverse impacts to soils. To provide connectivity to already existing trails, three new trails are proposed in alternative B. Impacts to soils will be evaluated separately because these trails cross through a variety of soil types and the degree of impact differs on a localized level. In cases where exact trail location has not been determined, the refuge plans to use existing logging roads and avoid wetlands where possible to minimize the impact from and extent of new trail development. When not possible to avoid wetlands careful consideration of trail development and impacts will be conducted and alternatives evaluated in a subsequent environmental assessment. New trail construction, estimated at no greater than 7.5 miles, will cause short-term impacts to soils. Impacts from off-trail use will be the same as alternative A.

The creation of a boardwalk to connect Camp 70/Delta 13 trail to Brown Mountain Overlook trail will create short-term direct impacts to soils through trail construction. No construction other than placement of boardwalk pilings would be done in wetlands so there would be short-term localized effects to wetland soils during construction and potential for long-term impacts on wetland plants from the shading effect produced by the boardwalk itself. The purpose of the boardwalk is to provide a new trail connection which will help prevent greater long-term negative impacts to sensitive wetlands soils. By providing a path for users to cross over the wetlands and not through them, long-term effects to unsuitable and highly compactable soils will be avoided.

Over the long-term, the risk of erosion and sedimentation problems that might affect these habitats would increase with increased visitor usage and trail use. At current levels the trail system supports hiking, biking, and horseback riding and each trail is designated for the uses its soil types are capable of supporting. Wetland complexes adjacent to active trails, like the Middle Valley trail and South Glade Run Crossing trail, would be of particular concern as degradation from hiking, biking, and horseback riding would increase the potential for soil compaction, erosion, and sedimentation into adjacent wetlands and streams.

Impacts of Alternative C (Maximize Public Use)

Benefits

Benefits to soils would be similar to alternative B although they would be reduced from increased visitor use, increased trail miles, and increased visitor infrastructure.

Adverse Impacts

Short-term and long-term adverse impacts to soils are greatest in alternative C than any of the other alternatives. Under alternative C the refuge will maximize public use opportunities, increase trail miles, and increase visitor infrastructure (see Table 4.3) in comparison to alternative B.



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Youth Conservation Corps building a boardwalk extension

Camp 70 road improvements in alternative C, whether the entire or part of the road's length, would occur on a highly modified substrate that was initially graded for vehicle use. Because of this, adverse impacts to soils would be minimal. There are areas along the road where Mauch Chunk-derived soils have been exposed and are highly susceptible to compaction and erosion. The refuge would seek to improve these sensitive road segments during road improvement projects to prevent further damage from compaction and erosion.

The creation of a cross valley trail from Brown Mountain Overlook to A-Frame Road requires crossing through approximately one mile of wetlands that contain rare plant communities. These soils are highly susceptible to compaction and the extent of possible damage to soil

integrity is severe (Bell 2001). Given these soil characteristics, trail creation and maintenance would directly and adversely impact soils and impact sensitive plant communities. A portion of this route will follow an existing railroad grade, thus mitigating soil impacts where the railroad grade is in good condition. About 2,200 feet of the railroad grade are completely inundated and will be circumvented

by using a new trail. The refuge would construct boardwalks in areas where sensitive wetland soils would likely be affected by foot traffic and a bridge over the Little Blackwater River where riverbanks would be susceptible to erosion. Adding this infrastructure is necessary to prevent or minimize adverse impacts to sensitive wetland soils. As in Alternative B, this new trail construction which requires the use of undisturbed habitat or could impact wetlands will be evaluated fully in a subsequent environmental assessment.

Off-trail use would adversely impact soils through compaction, erosion, and sedimentation. Impacts might be minimized as users would be spread over a large area. However, it will be difficult for the refuge to locate, monitor, and remediate impacted soils due to unpredictable visitor use and spatial extent of the off-trail use zone. Soils associated with steep slopes and wetlands are likely to be the most impacted (Bell 2002, Rizzo 2002). In an effort to offset these adverse impacts the refuge is limiting visitor use to 25 permits per month on Sundays during the hunting season. By issuing special use permits the refuge would be able to gather information on the number of users, the days and duration of use, and approximate location of use. This information would enable the refuge to monitor known locations of off-trail use for damage and perform remediation measures as needed. For additional information on the impacts related to the off-trail use zone see “*Effects of Public Use and Access, Public Use and Access Impacts from Alternative B.*”

Impacts of Alternative D (Focus on Managing for Historical Habitat)

Benefits

Beneficial impacts from alternative D are similar to those discussed in “*Soil Impacts of Alternative B.*” Soils would additionally benefit from limited vehicle access (same as alternative A) and a decrease in trail miles as a result of trail closures or changes from proposed trail connections in alternative B.

Adverse Impacts

Under alternative D, soils would be the least impacted in comparison to the other alternatives. Alternative D limits vehicle access (same as alternative A), decreases trail miles, and does not provide an off-trail use zone as discussed in alternative C. While trail closures would beneficially impact associated soils, increased concentrations of visitors on designated trails might potentially increase soil damage. Those impacts would be minimal because trails were designated for use based on the soil’s ability to support those uses. Where impacts occur the refuge would perform remediation and restoration measures.

Effects on the Socioeconomic Environment

In support of analyzing the economic consequences of the actions proposed in the four draft CCP/EA alternatives, we enlisted the assistance of social scientists and economists from the U.S. Geological Survey (USGS) – Fort Collins Science Center. Their analysis, a regional socioeconomic impact analysis, provides a means of estimating and comparing how current management under alternative A, and proposed management under alternatives B, C, and D, could affect the local and regional socioeconomic environment. In this chapter, we present the economic impacts first, followed by the social impacts.

Effects on the Regional Economy

For refuge CCP planning, an economic analysis provides a means of estimating how current management (No Action Alternative) and proposed management activities (alternatives) affect the local economy. This type of analysis provides two critical pieces of information: 1) it illustrates a refuge’s contribution to the local community; and 2) it can help in determining whether economic effects are or are not a real concern in choosing among management alternatives.

It is important to note that the economic value of a refuge encompasses more than just the impacts on the regional economy. Refuges also provide substantial nonmarket values (values for items not exchanged in established markets) such as maintaining endangered species, preserving wetlands, educating future generations, and adding stability to the ecosystem (Carver and Caudill, 2007). However, quantifying these types of nonmarket values is beyond the scope of this study.

The refuge management activities of economic concern in this analysis are:

- Refuge purchases of goods and services within the local community.
- Refuge personnel salary spending.
- Spending in the local community by refuge visitors.
- Revenues generated from Refuge Revenue Sharing.

For the full report on economic impacts, refer to appendix H.

Methods for a Regional Economic Impact Analysis

Economic input-output models are commonly used to determine how economic sectors will and will not be affected by demographic, economic, and policy changes. The economic impacts of the management alternatives for Canaan Valley National Wildlife Refuge were estimated using IMPLAN (Impact Analysis for Planning), a regional input-output modeling system developed by the USDA Forest Service. IMPLAN is a computerized database and modeling system that provides a regional input-output analysis of economic activity in terms of 10 industrial groups involving more than five hundred economic sectors (Olson and Lindall, 1999). The IMPLAN model draws upon data collected by the Minnesota IMPLAN Group from multiple federal and state sources including the Bureau of Economic Analysis, Bureau of Labor Statistics, and the U.S. Census Bureau (Olson and Lindall, 1999).

For each alternative, regional economic effects from the IMPLAN model are reported for the following categories:

- Local Output represents the change in local sales or revenue.
- Personal Income represents the change in employee income in the region that is generated from a change in regional output.
- Employment represents the change in number of jobs generated in the region from a change in regional output. IMPLAN estimates for employment include both full time and part time workers, which are measured in total jobs.

The economic impacts reported in this report are on an annual basis in 2006 dollars. Large management changes often take several years to achieve. The estimates reported for alternatives B, C, and D represent the final economic effects after all changes in management have been implemented.

Impacts of Alternative A

Table 4.4 summarizes the direct and total economic impacts of all refuge management activities for alternative A in Tucker County and the city of Elkins. Under alternative A, refuge management activities directly related to all refuge operations generate an estimated \$1.62 million in local output, 15.6 jobs and \$344 thousand in personal income in the local economy. Including direct, indirect, and induced effects, all refuge activities would generate total economic impacts of \$1.95 million in local output, 20.9 jobs and \$442.7 thousand in personal

income. In 2006, total personal income was estimated at \$666.3 million and total employment was estimated at 9,488 jobs for Tucker County and the city of Elkins (U.S. Department of Commerce, 2008, IMPLAN 2006 data). Total economic impacts associated with refuge operations under alternative A represent less than one percent of total income (0.1%) and total employment (0.2%) in the overall Tucker County and the city of Elkins economy. Total economic effects of refuge operations play a much larger role in the Canaan Valley communities near the refuge such as Davis, Thomas, and Parsons where most of the refuge's public use related economic activity occurs.

Table 4.4. Economic impacts of all refuge management activities for alternative A (2006\$).

	Local output	Personal income	Employment (# jobs)
<i>Refuge revenue sharing</i>			
Direct effects	\$85,300	\$28,400	1
Total effects	\$103,100	\$33,900	1.2
<i>Refuge administration (staff salary spending and work related purchases)</i>			
Direct effects	\$475,200	\$87,800	3.8
Total effects	\$566,200	\$116,200	5.1
<i>Public use activities</i>			
Direct effects	\$1,062,000	\$227,700	10.8
Total effects	\$1,278,500	\$292,600	14.6
<i>Aggregate impacts</i>			
Direct effects	\$1,622,500	\$344,000	15.6
Total effects	\$1,947,800	\$442,700	20.9

Impacts of Alternative B

Table 4.5 summarizes the direct and total economic impacts of all refuge management activities for alternative B in Tucker County and the city of Elkins. Under alternative B, refuge management activities directly related to all refuge operations generate an estimated \$1.71 million in local output, 16.3 jobs and \$361.6 thousand in personal income in the local economy. Including direct, indirect, and induced effects, all refuge activities would generate total economic impacts of \$2.05 million in local output, 21.9 jobs and \$465.9 thousand in personal income. Total economic impacts associated with refuge operations under alternative B represent well less than one percent of total income (0.1%) and total employment (0.2%) in the overall Tucker County and the city of Elkins economy. Total economic effects of refuge operations play a much larger role in the Canaan Valley communities near the refuge such as Davis, Thomas, and Parsons where most of the refuge's public use related economic activity occurs.



Ken Sturm/USFWS

Spring peeper on alder leaf

Table 4.5 Summary of all refuge management activities for alternative B (2006\$).

	Local output	Personal income	Employment (# jobs)
<i>Refuge Revenue Sharing</i>			
Direct effects	\$85,300	\$28,400	1
Total effects	\$103,100	\$33,900	1.2
<i>Refuge administration (staff salary spending and work related purchases)</i>			
Direct effects	\$610,000	\$112,900	4.9
Total effects	\$726,900	\$149,400	6.6
<i>Public use activities</i>			
Direct effects	\$1,074,100	\$230,100	10.9
Total effects	\$1,292,900	\$295,600	14.7
<i>Aggregate impacts</i>			
Direct effects	\$1,769,400	\$371,400	16.8
Total effects	\$2,122,900	\$478,900	22.5

Table 4.6 summarizes the change in economic effects associated with refuge operations under alternative B as compared to alternative A. Due to increases in refuge administration and visitation, alternative B would generate \$105.4 thousand more in local output, 1 additional job and \$23.3 thousand more in personal income as compared to alternative A.

Table 4.6. Change in economic impacts under alternative B compared to alternative A (2006\$).

	Local output	Personal income	Employment (# jobs)
<i>Refuge Revenue Sharing</i>			
Direct effects	\$0	\$0	0
Total effects	\$0	\$0	0
<i>Refuge Administration (staff salary spending and work related purchases)</i>			
Direct effects	+\$134,800	+\$25,100	+1.1
Total effects	+\$160,700	+\$33,200	+1.5
<i>Public use activities</i>			
Direct effects	+\$12,100	+\$2,400	+0.1
Total effects	+\$14,400	+\$3,100	+0.1
<i>Aggregate impacts</i>			
Direct effects	+\$146,900	+\$27,500	+1.2
Total effects	+\$175,100	+\$36,500	+1.6

Impacts of Alternative C

Table 4.7 summarizes the direct and total economic impacts of all refuge management activities for alternative C in Tucker County and the city of Elkins. Under alternative C, refuge management activities directly related to all refuge operations generate an estimated \$1.93 million in local output, 18.4 jobs and \$405.5 thousand in personal income in the local economy. Including direct, indirect, and induced effects, all refuge activities would generate total economic impacts of \$2.32 million in local output, 24.6 jobs and \$523.2 thousand in personal income. Total economic impacts associated with refuge operations under alternative C represent well less than one percent of total income (0.1%) and total

employment (0.3%) in the overall Tucker County and the city of Elkins economy. Total economic effects of refuge operations play a much larger role in the Canaan Valley communities near the refuge such as Davis, Thomas, and Parsons where most of the refuge's public use related economic activity occurs.

Table 4.7. Summary of all refuge management activities for alternative C (2006\$).

	Local output	Personal income	Employment (# jobs)
<i>Refuge Revenue Sharing</i>			
Direct effects	\$85,300	\$28,400	1
Total effects	\$103,100	\$33,900	1.2
<i>Refuge administration (staff salary spending and work related purchases)</i>			
Direct effects	\$674,500	\$126,600	5.5
Total effects	\$805,800	\$167,600	7.4
<i>Public use activities</i>			
Direct effects	\$1,168,100	\$250,500	11.9
Total effects	\$1,406,200	\$321,800	16.0
<i>Aggregate impacts</i>			
Direct effects	\$1,927,900	\$405,500	18.4
Total effects	\$2,315,100	\$523,200	24.6

Table 4.8 summarizes the change in economic effects associated with refuge operations under alternative C as compared to alternative A. Due to increases in refuge administration and visitation, alternative C would generate \$367.3 thousand more in local output, 3.7 additional jobs and \$80.6 thousand more in personal income as compared to alternative A.

Table 4.8. Change in economic impacts under alternative C compared to alternative A (2006\$).

	Local output	Personal income	Employment (# jobs)
<i>Refuge Revenue Sharing</i>			
Direct effects	\$0	\$0	0
Total effects	\$0	\$0	0
<i>Refuge Administration (staff salary spending and work related purchases)</i>			
Direct effects	+\$199,300	+\$38,800	+1.7
Total effects	+\$239,600	+\$51,400	+2.3
<i>Public use activities</i>			
Direct effects	+\$106,100	+\$22,800	+1.1
Total effects	+\$127,700	+\$29,200	+1.4
<i>Aggregate impacts</i>			
Direct effects	+\$305,400	+\$61,600	+2.8
Total effects	+\$36,300	+\$80,600	+3.7

Impacts of Alternative D

Table 4.9 summarizes the direct and total economic impacts of all refuge management activities for alternative D in Tucker County and the city of Elkins. Under alternative D, refuge management activities directly related to all refuge operations generate an estimated \$1.67 million in local output, 15.9 jobs and \$352.3 thousand in personal income in the local economy. Including direct, indirect, and induced effects, all refuge activities would generate total economic impacts of \$2.01 million in local output, 21.4 jobs and \$453.6 thousand in personal income. Total economic impacts associated with refuge operations under alternative D represent well less than one percent of total income (0.1%) and total employment (0.2%) in the overall Tucker County and the city of Elkins economy. Total economic effects of refuge operations play a much larger role in the Canaan Valley communities near the refuge such as Davis, Thomas and Parsons where most of the refuge’s public use related economic activity occurs.

Table 4.9. Summary of all refuge management activities for alternative D (2006\$).

	Local output	Personal income	Employment (# jobs)
<i>Refuge Revenue Sharing</i>			
Direct effects	\$85,300	\$28,400	1
Total effects	\$103,100	\$33,900	1.2
<i>Refuge administration (staff salary spending and work related purchases)</i>			
Direct effects	\$526,500	\$96,100	4.1
Total effects	\$626,000	\$127,00	5.6
<i>Public use activities</i>			
Direct effects	\$1,062,000	\$227,700	10.8
Total effects	\$1,278,500	\$292,600	14.6
<i>Aggregate impacts</i>			
Direct effects	\$1,673,800	\$352,300	15.9
Total effects	\$2,007,600	\$453,600	21.4

Table 4.10 summarizes the change in economic effects associated with refuge operations under alternative D as compared to alternative A. Due to increases in refuge administration; alternative D would generate \$59.8 thousand more in local output, half of an additional job and \$10.9 thousand more in personal income as compared to alternative A.

Table 4.10. Change in economic impacts under alternative D compared to alternative A (2006\$).

	Local output	Personal income	Employment (# jobs)
<i>Refuge Revenue Sharing</i>			
Direct effects	\$0	\$0	0
Total effects	\$0	\$0	0
<i>Refuge Administration (staff salary spending and work related purchases)</i>			
Direct effects	+\$51,300	+\$8,300	+0.3
Total effects	+\$59,800	+\$10,900	+0.5
<i>Public use activities</i>			
Direct effects	\$0	\$0	0
Total effects	\$0	\$0	0
<i>Aggregate impacts</i>			
Direct effects	+\$51,300	+\$8,300	+0.3
Total effects	+\$59,800	+\$10,900	+0.5

Summary and Conclusions

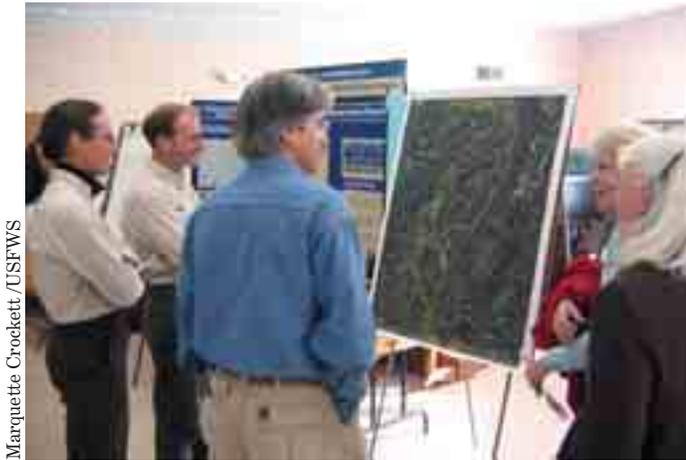
Under alternative A, refuge management activities directly related to all refuge operations generate an estimated \$1.62 million in local output, 15.6 jobs and \$344 thousand in personal income in the local economy (Table 4.4). Including direct, indirect, and induced effects, all refuge activities under alternative A would generate total economic impacts of \$1.95 million in local output, 20.9 jobs and \$442.7 thousand in personal income. Likewise, alternative B refuge management activities directly related to all refuge operations would have an aggregate impact of an estimated \$1.71 million in local output, 16.3 jobs, and \$362 thousand in personal income. Economic impacts of alternative C include a direct effect of an estimated \$1.93 million in local output, 18.4 jobs, and \$405 thousand in personal income. Impacts from alternative D are estimated at \$1.67 million in local output, 15.9 jobs, and \$352 thousand in personal income. Total economic impacts associated with refuge operations across all alternatives represent well less than one percent of total income and total employment in the overall Tucker County and the city of Elkins economy. Total economic effects of refuge operations play a much larger role in the Canaan Valley communities near the refuge such as Davis, Thomas and Parsons where most of the refuge's public use related economic activity occurs.

Effects on the Social Environment**Methods for the Social Science Analysis**

Social science researchers at the USGS-Fort Collins Science Center conducted a stakeholder assessment in February 2007. Information on stakeholder preferences and values is based on this evaluation (Sexton, Burkardt, Swann and Stewart, 2009). The first step in the stakeholder evaluation was identification of the key groups and individuals with an interest or role in the Canaan Valley refuge planning process. One hundred stakeholders were identified and invited to meet with USGS researchers one-on-one at Canaan Valley State Park in late winter of 2007. Each stakeholder was given a set of 47 statements about key refuge issues and asked to sort and rank these statements from "strongly agree" to "strongly disagree." Five prevailing perspectives were identified related to these key Refuge issues: Ecological Preservation; Recreational Access; Traditional Wildlife Management; Wildlife First/Recreation Second; and Economic Development. The Ecological Preservation Perspective emphasizes protecting wildlife and habitats, with wetland protection being especially important. The Recreational Access Perspective places the greatest emphasis on recreational access to the refuge. Stakeholders from this perspective embrace a larger landscape perspective that includes trail connectivity with neighboring public lands as well as continuous, looped, and easy trails on the refuge geared toward families, the elderly, and the disabled. The Traditional Wildlife Management Perspective emphasizes management for game species such as deer, grouse, and woodcock. This perspective supports an increase in deer harvest (both for recreation and for protecting refuge resources) and an increase in hunter access. The Wildlife First/Recreation Second Perspective is similar to the Ecological Preservation Perspective in that its primary concerns are protecting wetlands and water quality, acquiring lands within the refuge acquisition boundary, and controlling invasive species. What makes this perspective unique is that it values the importance of recreational access on the refuge, so long as resources can be protected and the refuge mission can be upheld. Finally, the Economic Development Perspective is primarily concerned with maintaining and improving the economic vitality of the valley. This perspective supports development, particularly industrial development, and sees the refuge and other public lands as an impediment to growth.

The information gathered in the USGS stakeholder analysis was used to predict the potential social effects of the proposed alternatives.

Impacts on Hunting from Alternative A



Marquette Crockett / USFWS

Comprehensive Conservation Plan Open House

Beneficial Impacts:

This alternative helps the Refuge provide a quality priority public use and complies with existing State hunt seasons and regulations. Refuge hunting helps maintain healthy animal populations. In particular the deer hunt program addresses the biological impacts of the large deer population, which may be seen as beneficial by those holding the Ecological Preservation perspective. Hunting is part of the cultural heritage of the region, and this alternative supports that heritage. Hunting generally causes only minimum disturbance to birds because it occurs at a time of year when many avian species have left the area. Those holding the Ecological Preservation and Traditional Wildlife Management perspectives are likely to see value in this. Hunt seasons also occur during a time of year when visitation on the refuge is low because of snow and cold weather. This helps to minimize conflicts and potential safety issues between hunters and other refuge users.

This alternative provides off-trail access for hunters to assist in the tracking or recovery of game. This may lead to more productive hunts, increased hunter satisfaction, and protection of the refuge's resources. The use of pursuit dogs for some upland game hunting may also increase hunter satisfaction and hunt productivity. The Refuge also provides hunting blinds. Additionally, this alternative includes provisions for cooperative deer hunts (with surrounding landowners) as a means of managing deer population size. Each of these activities is valued by those holding a Traditional Wildlife Management perspective, partially because more productive hunts will support the goal of deer population management. Under this alternative the Refuge would provide a youth hunting program, which may instill an appreciation for hunting and encourage life-long hunting. One goal of all of the Refuge hunting programs is to instill positive hunting values and hunting ethics.

Adverse Impacts:

Some hunting activities in this alternative have adverse social impacts. Allowing the use of pursuit dogs for hunting may be considered inhumane by some. Although this was not commonly mentioned during our stakeholder assessment, it is known to be a concern for some members of the public (see Decker et al. 1993; Loker and Decker 1995; Peyton 1998; Lafon, McMullin, and Steffen 2003). For those who oppose hunting on moral or ethical grounds, any hunting is likely to be viewed as an adverse impact.

Other adverse impacts of hunting are related to special activities or access granted to hunters. For example, permitting hunters off-trail and permitting hunting dogs off-leash may be seen as unfair to non-hunters. Those holding a Recreational Access or Economic Development perspective may hold this view. Likewise, allowing off-trail access to hunters may be viewed negatively, especially by those in the Recreational Access perspective, who seek fewer restrictions on access for all Refuge users, not just hunters.

Finally, hunting may lead to conflicts and safety issues between hunters and other Refuge users. The extensive literature on outdoor recreation conflicts proposes that when recreational users perceive that their ability to pursue their activities is diminished by the activities of others, that goal interference is likely to cause conflict (see Jacob and Schreyer 1980; Vaske, Donnelly, Wittmann and

Laidlaw 1995; Carothers, Vaske and Donnelly 2001). The literature suggests that when different types of users depend on a location for recreational benefits there may be real or perceived conflict and this may be a negative social impact.

Safety issues may be minimized because non-hunters may avoid certain areas during hunting season. Those who use areas where hunting is permitted are encouraged to wear hunter orange, and hunters are encouraged to follow safe hunting practices.

Impacts on Hunting from Alternative B

Beneficial Impacts:

This alternative would provide all of the benefits of Alternative A as well as some additional benefits. This alternative includes several actions that could increase deer harvest, such as modifying the “no rifle zones.” The areas in which these zones are proposed are in the southern end of the valley and this may help reduce high deer densities in that part of the refuge. Alternative B also proposes to assist hunters with extraction of deer from remote places (such as shuttle system for deer). Both these proposals would contribute to decreasing the damage done by deer to refuge resources. These proposals would also increase the available areas on the refuge that are open for hunting, would provide more hunting opportunities, could increase hunter satisfaction and could encourage hunters who might not otherwise participate. Working with our state partners and other surrounding landowners to help reduce the deer herd could provide additional opportunities for hunting, and may be effective in reducing deer populations. Together, these proposals could improve the level of ecological integrity of the Refuge (supported by the Ecological Preservation perspective) and could increase the number of hunters who visit the area and put dollars into the local economy, which would be valued by those who hold the Economic Development and Traditional Wildlife Management perspectives.

Alternative B also promotes scientific research on the Refuge’s deer population, which may help the Refuge to better understand and manage deer. Also, requiring hunters to obtain a special use permit to hunt rabbit will enable the refuge to gain more information about the eastern versus Appalachian cottontail population on the refuge. Many of the perspectives in the stakeholder assessment noted the importance of basing management decisions on research and scientific evidence, so these activities may be seen as beneficial by those holding these views.

Many stakeholders emphasized the importance of developing partnerships, and this Alternative focuses on several of these arrangements. In addition to the intrinsic value of these partnerships, working with the state DNR on deer harvest issues would support the refuges’ objectives of reducing the deer herd on the refuge and providing a higher quality white tailed deer hunting experience. Working with the state legislature on deer related issues may result in increased funding, increased visibility of the refuge to state officials, and a stronger relationship with the state DNR.

Access issues are important to hunters, and this alternative addresses these concerns by allowing limited vehicular access to North Beall Road. The benefits of increasing access could be better deer management and greater hunter satisfaction.

Using outreach and education to inform the public about the impacts of overabundance of deer, and the benefits of hunting as a deer management tool could improve understanding of the interdependencies of the ecological system. The benefits of this improved understanding could include greater acceptance of

management decisions and the individual benefit of increased knowledge of the natural world.

Adverse Impacts:

Alternative B would result in all the adverse impacts that occur under Alternative A plus some additional adverse impacts. Many of these additional adverse impacts are related to Refuge access, which was an important issue to many of the stakeholders.

Increasing the number of rifle hunting areas may result in additional user conflicts between hunters and non-hunters, an issue that may affect the Recreational Access perspective. Both the Recreational Access and Economic Development perspectives may be opposed to increasing access for hunters. The Recreational Access perspective may object on the basis of unfairness of unequal access, while the Economic Development perspective may believe that encouraging access for only “die hard” recreational users and hunters limits visitation and curtails economic development opportunities. Other enhancements that favor hunters may cause adverse impacts. For example, assisting hunters with game retrieval would provide special access for a specific group (hunters) and may cause damage to Refuge resources. Those holding an Ecological Preservation perspective may be especially aware of this. In more general terms, providing shuttles, improving roads, and investing in other improvements for hunting access would use budget dollars that could support other Refuge activities and users.

Requiring hunters to obtain a special use permit to hunt rabbit may result in some inconvenience for hunters, but it is necessary for gathering more information about the rabbit population in the valley.

Impacts on Hunting from Alternative C

Beneficial impacts:

Alternative C offers all of the benefits of Alternative B.

Adverse impacts:

Alternative C would result in the same adverse impacts as Alternative B.

Impacts on Hunting from Alternative D

Beneficial impacts:

In addition to the benefits described in Alternative B, this alternative may decrease user conflicts by eliminating some species from the hunt list. Fewer species to hunt may result in fewer hunters, therefore resulting in fewer conflicts between hunters and non-hunters. This would be appreciated by the Recreational Access perspective. Most of the species proposed to be removed from the hunt list are rarely found on the refuge. Therefore, users aligned with the Recreational Access perspective could also reap the benefits of viewing and photographing wildlife that only occasionally appears on the refuge since these species would be off-limits to hunters. Users aligned with the Ecological Perspective may appreciate the removal of some species from the hunt list because it protects these rare visitors to the refuge.

Adverse impacts:

In addition to the adverse impacts noted in Alternative B, this alternative may have adverse impacts on hunters because of the removal of some species from the hunt list. Although these species are only rarely seen on the refuge, removing them from the hunt list could result in a lower quality hunting experience by users from the Traditional Wildlife Management Perspective.

Impacts on Fishing from Alternative A

Beneficial impacts:

Alternative A provides the benefit of a priority public wildlife-dependent recreational use of the Refuge. The Refuge participates in fishing derbies and other community events, and these provide the benefit of connecting the community—and children, in particular—to the outdoors. This may lead to an increased appreciation of the refuge and its resources, and of the natural world in general. The Refuge also provides an accessible fishing area, which confers the benefit of access to those with limited mobility.

Adverse impacts:

In terms of adverse impacts, under this alternative fishing access is limited to places where roads or trails cross a waterway. This limitation may be viewed negatively by those with a Recreational Access or Economic Development perspective.

Impacts on Fishing from Alternative B

Beneficial impacts:

This alternative provides all of the benefits of Alternative A, and provides additional benefits. Under this alternative, the Refuge would officially open and actively promote fishing and provide access, more signage, and education programs. The benefits of this increased attention to fishing include enhanced opportunities for people of all abilities to participate in fishing, and more flexibility for Refuge to provide a wildlife-dependent activity to the public. This may lead to greater participation and a higher degree of public appreciation of Refuge resources.

Adverse impacts:

All of the adverse impacts that occur under Alternative A would also occur under Alternative B. An additional adverse impact under Alternative B may be that enhancing and promoting the refuge’s fishing program could require expenditures that could be used to provide other public benefits. Also, increased numbers of anglers may lead to conflicts between Refuge user groups.



Ken Sturm/USFWS

Headwaters of North Branch

Impacts on Fishing from Alternative C

Same as alternative B

Impacts on Fishing from Alternative D

Beneficial impacts:

This alternative provides all of the benefits of Alternative B, and provides additional benefits. The opportunity to fish native-only streams may appeal to some anglers and may provide high-quality fishing experiences. This may be especially important to the Wildlife First/Recreation Second perspective, the Ecological Preservation perspective and, to some degree, the Traditional Wildlife Management perspective.

Adverse Impacts:

All of the adverse impacts discussed under Alternative B could also occur under Alternative D. Additional adverse impacts could result from stocking only native fish. If native fish species are the focus of management activities, fishing may be limited and some anglers may choose to fish elsewhere. Also, active management of native fish species may be costly to the Refuge and may limit funding for other public use programs and activities. Finally, stocking only native fish could pose a burden on the State, which is usually the entity that stocks streams and rivers.

Impacts on Wildlife Observation and Photography from Alternative A

Beneficial Impacts:

The refuge will continue to have 31 miles of roads and trails open throughout the year for visitors. This access provides opportunities for wildlife viewing and photography, which are important Refuge uses. Leashed dogs will be permitted on the refuge which may encourage public use of the refuge for users beyond hunters, birdwatchers, etc, and may lead to more people (including young families and seniors with pets) gaining an appreciation for the refuge's resources. Completion of a boardwalk loop at the Freeland Tract is planned and will expand access opportunities for the public, especially for the elderly and the disabled, while protecting fragile resources.

Of the 31 miles of roads and trails open throughout the year for visitors, cross-country skiers and those on snowshoes will also have access to an additional 10 miles of commercially operated trails on the refuge, in cooperation with White Grass Ski Touring Center. This will continue to provide economic benefits to the community from nonlocal visitors, and promote appreciation for wildlife and support for refuge programs. Off-trail skiing will still not be permitted on refuge land to ensure that habitat is protected, especially at critical times. This may be important to the Ecological Preservation perspective and ensures the mission and establishing purpose of the refuge can be upheld.

The refuge will continue to implement refuge-volunteer-based programs to maintain and improve trail conditions, signs, and blazing. These valued partnerships will continue to support public use on the refuge.

Canoe and boat access will stay the same, with the refuge maintaining three boat launches. This provides opportunities for wildlife viewing and photography along the Blackwater River.

Adverse Impacts:

The unmaintained Delta 13/Camp 70 Road will continue to be claimed and unmaintained by WVDOT. Because Camp 70 road is used as a main trail access to the refuge, the inability to address the need to improve this road will create a negative impression of the refuge to public users about refuge maintenance.

Choosing to not increase public use and access will have adverse social impacts. From the USGS research, some issues of highest consensus and concern included: "providing continuous looped trails; a connected trail system that would provide recreational and economic opportunities; and restoring railroad grades to view habitat while avoiding damage to bogs." Of lower concern but still of importance, stakeholders expressed "the desire for better access for people of all physical abilities" and "supporting low-impact mountain biking." The stakeholders interviewed by USGS staff supported providing this access while "protecting diverse wetlands and water quality."

Continuing current public use and access policies with no increase in access opportunities may lead to deterioration of the community's attitude towards and support for the refuge and its mission.

Impacts on Wildlife Observation and Photography from Alternative B

Beneficial Impacts:

Alternative B provides additional benefits above and beyond those discussed in Alternative A. Providing opportunities for wildlife observation and photography is recognized as a priority use and is seen as integral to the management of the refuge. In this alternative significant changes to the present level of public use and access are proposed.

The new trails proposed in Alternative B add about 4.8 miles of new trails, with many creating looped trails. Results from the USGS research showed that there

was agreement across perspectives that continuous, looped trails were highly desirable. Stakeholder interviews also revealed support for easy trails that would provide increased access, especially for young families, the elderly and the disabled.

Many of these new trails reflect suggestions by stakeholders during interviews. After analysis and review, five specific trail suggestions were incorporated directly into this alternative by the refuge planning team. The trail suggestions made by stakeholders that were accepted as viable solutions to access issues are designated by bold text in table below. These efforts by the refuge planning team to include stakeholder suggestions may be seen as a positive community building effort.

These new trail combinations may encourage visitors who might not otherwise enter the refuge due to limited looping trails. It may also encourage local visitors to once again explore the refuge. During USGS research efforts, one stakeholder said “More access will provide unique experiences, giving the public the ability to enjoy more interesting and unusual places on the refuge so appreciation of resource can occur.” Additional trail connections with adjacent landowners will be considered as partnerships are established. This will lead to greater connectivity and use of more stakeholder suggestions.

Any increase in access will be especially supported by the Recreation Access perspective, where many users valued both the physical and mental health benefits from being active out-of-doors. They may see new trails and more open access as directly improving the quality of their active life style. The Traditional Wildlife Management, Ecological Preservation, and Wildlife First Recreation Second perspectives may support increased access if they believe that the protection of wildlife, water quality, and wetlands are the driving force for access decisions. The Economic Development Perspective may support this alternative because the more robust access could increase visitor satisfaction, encouraging non-locals to visit repeatedly due to the quality of recreational opportunities. Increased visits would benefit some local small businesses tied to tourism. Cyclists and horseback riders will especially benefit from the increase in trail connectivity because it will provide longer trails and thus a higher quality experience.

Continued efforts by refuge staff to collaborate with others (Canaan Valley Institute, West Virginia Department of Natural Resources, USDA Monongahela National Forest and Dolly Sods Wilderness Area, Tucker County Trails, Highland Trails Initiative, USFWS, private land owners, etc) on trail connectivity is likely to be supported across perspectives. It was agreed across all perspectives that “A connected trail system would provide recreational and economic opportunities.” Continued efforts by refuge staff to collaborate with new partners will be seen as positive by most, and will improve relationships between the Refuge, community groups, and other collaborative partners. These efforts will also be a positive force in capacity building for those participating in future collaborations.

Alternative B provides improvements for high quality wildlife viewing on the refuge. Where A-frame Road enters the Refuge an observation platform will be constructed high enough to give a good view of the valley. Additionally, an observation blind at the end of A-frame Road between the two beaver ponds is planned. The proposed action of closing Freeland Tract to hunting, fishing, and dog-walking, except for special deer hunts, could also provide a higher quality wildlife viewing and study area because there could be fewer user conflicts and more wildlife to view given the decrease in disturbance from dogs and hunters.

Increased opportunities for quality wildlife viewing may increase visitation and improve visitor satisfaction. The ease of access to some platforms and blinds may encourage wildlife viewing by a variety of users, including photographers, birdwatchers, and young families, elderly, and the disabled. This may lead to an increase in return visits, which may positively impact the local economy.

Alternative B would improve signage for cross country skiers on the refuge in collaboration with White Grass Ski Touring Center to discourage off trail skiing. Providing better signs indicating the location of trails, and providing interpretive information on the Cheat Mountain salamander habitat protection efforts, would enhance cross country skiing and snowshoeing experiences. Narrowing some trails to protect habitat may be seen as beneficial to those with an Ecological Preservation perspective. On the other hand, those from the Recreation Access perspective may not benefit from narrower trails, as they may eventually prohibit trail grooming.

If the state abandons the Delta 13 Road, alternative B's proposal would significantly improve the quality of non-vehicle access. The refuge would rehabilitate the road into a quality multi-use trail for pedestrians, bikers, and horseback riding. This would increase quality wildlife viewing for roadside vernal pools, which are home to amphibians. This would provide a higher quality visitors' experience for all users entering the refuge on the Delta 13 multiuse trail.

Alternative B proposes to improve two new boat launch sites. It also proposes to install a kiosk and directional signs to better indicate boat launch sites at Timberline Road, Old Timberline Road and Camp 70 Road. Both these actions could increase boater satisfaction, therefore leading to an increase in repeat visits, and increased revenue to local businesses linked to tourism. Communicating about sensitive areas along boating routes with local tourism businesses that cater to boaters may increase visitor understanding of Refuge resources and increase visitor appreciation for the habitat being protected.

This alternative permits overnight parking on FR 80 for access to Dolly Sods wilderness. This could increase visitor satisfaction, due to ease of access to Dolly Sods. This may increase repeat visits and possibly increase local business revenues.

Adverse Impacts:

Increasing trails may have adverse social impacts. Any increase in access may be scrutinized by the Ecological Preservation perspective to ensure that the refuge is upholding their mandate to protect the diverse wetlands. If there is a perception that access is being permitted at the expense of the resource this perspective may not be supportive. This perspective values wildlife and nature for the benefit to a larger ecosystem, and it has a moral concern for wildlife and nature.

On the other hand, the Recreational Access perspective may see this alternative as still falling short of providing adequate access and use, despite the fact that this alternative provides increased access and use compared with Alternative A. Although the refuge will work with partners to discuss additional trail connections on and off refuge, users of the Recreational Access perspective may want to see trail connectivity progress beyond the point of discussion. The refuge may have been limited in progressing further because of the time it takes to form these partnerships and engage in these discussions. Still, this alternative will not address connectivity to the breadth and depth discussed by many avid outdoors people who seek trail connectivity on a grander landscape scale. For example,

longer day or multiday hikers/backpackers who want to avoid roads altogether for a high quality recreational experience, or mountain bikers seeking longer, challenging day or multiday adventures want Canaan Valley refuge to be a small but integral part of a state/regional trail connectivity plan.

The Recreational Access perspective may also see this alternative falling short in regards to a bike corridor through refuge. A biking corridor was recognized as highly controversial with no agreement across perspectives on how to balance the extent of access with wildlife conservation.



Ken Sturm/USFWS

ATV damage at Jack Neal's Ford

Although the refuge currently uses some rail grades for access and is proposing to use additional railroad grades in this alternative, some stakeholders may be disappointed by the lack of additional rail grade restoration to facilitate public use. “Restoring railroad grades to view habitat while avoiding damage to bogs” was a highly important issue for several of the perspectives (Recreational Access, Economic Development, and Traditional Wildlife Management). In the interviews, following the Q sort by USGS researchers, restoring railroad grades was a prominent access solution suggested. The logic used reached across historical, utilitarian, economical, educational, and resource protection values. A discussion in Chapter 3, under “Actions Considered but eliminated from further Study” explains the reasoning behind rejecting the use of the south rail grade for recreation.

Finally, creating and opening additional trails for wildlife observation and photography may result in more user conflicts if this results in higher levels of visitation. If user conflicts do become an issue at Canaan Valley refuge over time, research on the nature of recreational conflict between mountain bikers and hikers (Dyck and Rule, 1978; Watson, Williams, and Daigle 1991; Ramthun 1995) suggests interpretive efforts can help. Efforts that explain behaviors, motivations and land use needs of other user groups may reduce perceptions of conflict. Some suggest educating hikers (and other user groups) about the rationale for cyclists’ distinctive clothing and about riding techniques that cyclists must use to ensure their safety. Local cycling organizations may develop educational materials or presentation on trail etiquette as well as encouraging local trail maintenance. Signs that orient all to the fact that a trail is shared by hikers, bikers, horses and other user groups may also be an important part of avoiding user conflict.

The costs of building and maintaining platforms and blinds may take funds away from other priorities. Closing the Freeland Tract may disappoint some hunters, fishermen and dog walkers, though it would benefit youth and physically disabled hunters. Also, the Refuge reserves the right to open the tract for a shorter season if the deer are having major impacts on the vegetation.

Narrowing some trails for habitat protection may reduce or eliminate grooming access by snowmobiles, which would in turn reduce the ease of ski access. This result could negatively impact some skiers’ experience on these trails. Narrowing trails may also cause some safety concerns for novice cross country skiers. Also, some skiers may be unwilling to stay on trails despite new signs. Monitoring and enforcement of off trail use may be difficult for refuge staff to accomplish.

Under this alternative, adverse impacts may include initial costs for rehabilitating the road/trail and long term costs for maintaining the trail. This may pull funds from other tasks. Those dependent on vehicles for access may not support this management action.

Providing two improved boat launch sites may invite more boaters to the refuge. This could potentially cause additional user conflicts. Also, it could cause more disturbance to wildlife along riparian corridors, therefore diminishing the quality of wildlife viewing opportunities for others.

A potential adverse impact of permitting overnight parking may be the necessity to request an overnight parking permit from refuge, which may pose an undue burden on some visitors. Also, increased law enforcement personnel may be required to check permits. Finally there could be an increase in litter, which could also result in more staff time for maintenance.

Impacts on Wildlife Observation and Photography from Alternative C

Beneficial impacts:

More miles of trails, and connected trails, would provide improved access for recreational users. A cross valley trail would be supported by Recreational Access and Economic Development perspectives. The stakeholder evaluation indicated a desire for cross valley connected trails in the northern part of the refuge. The Recreation Access Perspective strongly agreed with the Q statement, "Trail connectivity...through the use of a variety of old and or new trails, rails, and boardwalks is important."

"Restoring railroad grades to view habitat while avoiding damage to bogs" was supported by three of the five perspectives (Recreational Access, Economic Development, and Traditional Wildlife Management). In the interviews following the Q sort by USGS researchers, restoring railroad grades was a prominent access solution suggested. In recommending the restoration of railroad grades, the logic used reached across historical, utilitarian, economical, educational, and resource protection values, showing a potential for collaboration.

Opening all of Brown Mountain Overlook Trail to mountain biking would provide mountain biking access, as a shorter loop or as another option for accessing a cross valley trail to A Frame Road. Adding loops and connected trails are management actions supported by the Recreational Access and Economic Development perspectives. These types of opportunities will add variety to biking trips and may encourage more visitors to come to CVNWR and to return. Economic benefits may be possible for local tourism businesses.

Maintaining Delta 13/Camp 70 Road for motorized vehicles may allow additional visitors to utilize the area. This may include young families, the elderly, and disabled. An added parking area would provide easier access and may increase visits to this area while also dispersing recreational activities.

Opening off-trail use in an area designated on Sundays during the hunting season would increase access to new areas of the refuge. Permits would be limited to 25 per month. During the USGS research efforts, one stakeholder said, "More access will provide unique experiences giving the public the ability to enjoy more interesting and unusual places on the refuge so appreciation of resource can occur." Two Q statements that were seen of high consensus and high concern included: "I support new ideas for providing reasonable access while protecting fragile ecosystems, for example ...a permit system for backcountry use." And "It is unfair that hunters using the refuge have off-trail access, while other users must stay on the trails."

Requiring permits would help the refuge keep track of the number of off-trail users. By monitoring this area for resource damage, refuge staff could collect information that will help determine whether or not to modify the permitting system. The refuge would also seek funds to hire a graduate student or other research organization to conduct various studies that would monitor any impacts

to wildlife and their habitats in this off-trail zone. This effort is directly linked to requests by stakeholders that management decisions be based on science. These monitoring efforts would be supported by the Ecological Preservation perspective, Wildlife First, Recreation Second perspective and Recreational Access perspective.

The refuge would also seek funds to pay for a study to compare nesting success rates of forest interior birds inside and outside of the off-trail use area. Monitoring for resource damage, and research studies addressing the impacts of off-trail use on forest birds, would tie to the requests by stakeholders that management decisions be backed by science. These monitoring efforts would be supported by the Ecological Preservation perspective, Wildlife First, Recreation Second perspective and Recreational Access perspective.

Adverse impacts:

Same as Alternative B except for that the Cross Valley Trail may be cost-prohibitive to implement in a way that protects fragile wetland habitat. Creating a cross valley trail was seen as an area of high conflict among perspectives. The Ecological Preservation perspective highly values wetland preservation, and may be negatively impacted by this alternative.

Opening the refuge to off-trail use on Sundays during the hunting season may cause habitat damage and wildlife disturbance. Some hiking non-hunters will take advantage of this opportunity. Those in the Ecological Preservation perspective may believe that the potential for habitat damage and wildlife disturbance are adverse impacts of this alternative.

Monitoring effects of off-trail use and enforcing permits will be labor and time intensive for refuge staff, and will take away staff time and money from other projects related to the refuge's biological program. If an increase in staffing is not possible, extra responsibilities for existing refuge staff could require other tasks to be minimized or dropped.

Of all of the alternatives, this alternative most increases access opportunities for mountain bikers, which may negatively impact hikers, horseback riders, and other user groups (see Jacob and Schreyer 1980; Vaske, Donnelly, Wittman and Laidlaw 1995; Carothers, Vaske, and Donnelly 2001). As stated under Alternative B, research (Dyck & Rule 1978; Watson, Williams, and Daigle 1991; Ramthun 1995) suggests decreasing user group conflicts may be accomplished by increasing interpretive efforts that encourage tolerance. Multi-user trails may increase safety issues for all users. Acquiring jurisdiction to Delta 13/Camp 70 Road would require ongoing funding for maintenance and repairs.

Monitoring impacts and maintaining additional miles of public use trails would require increased staff time and funding to ensure trails are maintained for a quality experience. This would divert funds and staff time from other areas of refuge management.

Impacts on Wildlife Observation and Photography from Alternative D

Beneficial impacts:

Closing of these three trails would decrease access in comparison to Alternatives B and C. The Ecological Preservation perspective would benefit from this alternative, especially in regards to closing the Powderline trail to protect Cheat Mountain Salamander. This is illustrated by strong disagreement from this perspective on the Q statement, "Increasing access is more important than ecosystem health."

Impacts on Environmental Education and Interpretation from Alternative A

Adverse Impacts:

Immediately closing Powderline trail would negatively impact White Grass Ski Touring Center, which maintains this trail for cross country skiing on the refuge. It would also reduce connectivity between the refuge and the State Park. Access would be decreased in comparison to Alternatives B and C. This could negatively impact the Recreational Access Perspective.

Beneficial impacts:

This alternative exposes a large number of people to the Refuge because of the emphasis on on-site and off-site programs. This could lead to a broader understanding of and support for the Refuge mission and Refuge resources. Those from more than one of the perspectives could appreciate the effects of these programs: the Ecological Preservation perspective might support the focus on learning about and protecting resources; the Wildlife First/Recreation Second perspective might be interested in the emphasis on appreciating Refuge wildlife while engaging in recreational activities, and the Economic Development perspective could support efforts to attract visitors to the area.



Leah Ceperley/USFWS

Volunteers and staff, electrofishing crayfish run

Recruiting local volunteers provides the benefit of keeping the visitor center open more days per week, which allows the Refuge to provide programs and information on a more frequent basis. Some members of the public are likely to see the use of a STEP employee being of even greater benefit than the use of volunteers. The stakeholder study suggests that there is a desire among the public to have the visitor center open more and to have it staffed by FWS employees (in addition to volunteers).

The ongoing effort to be involved in community events has the potential to increase public awareness of and support for the Refuge. Stakeholders from several perspectives noted the need for increased community involvement and better communication by refuge staff.

These themes were especially important to the Recreational Access, Wildlife First/Recreation Second, and Economic Development perspectives.

Adverse impacts:

This alternative can cause negative impacts. On and off-site programs entail additional budget costs and use resources that could be available for other refuge programs. Members of the public who believe that the programs do not benefit them, or that providing programs is not the most effective use of resources, may not be satisfied with this alternative. Those identifying with the Ecological Preservation perspective may be likely to have this concern. Likewise, constructing a trailer pad may have negative ecological impacts that will concern some members of the public.

Opening the visitor center only four days a week is of concern to members of the public who believe that the center should be open on weekend days, because that is the time of highest potential visitation. USGS social scientists heard this concern across several perspectives, but it seemed most important for those in the Recreational Access and Economic Development perspectives. Because the programs provided in this alternative seem dependent on additional staff, one potential negative impact is that attempting to implement the programs will not be successful without additional staff.

Impacts on Environmental Education and Interpretation from Alternative B

Beneficial impacts:

This alternative may have a number of beneficial impacts over and above the beneficial impacts of Alternative A. Providing additional interpretative trails and more signs would increase the quality of visitor experiences. This is potentially appealing across several perspectives, but perhaps most important to those who are interested in viewing wildlife and learning about Refuge resources. Hiring additional staff for visitor services may also increase visitor satisfaction because of increased outreach to schools and the opportunities for visitors to learn about the refuge. A secondary benefit of additional staff is related to the refuge's public image and the ability to appear more adequately staffed and less reliant on volunteers to provide what some believe to be the refuge's core function. Constructing a pavilion on the Beall Trail for environmental education would allow refuge staff to take school groups into the field for extended periods of time therefore expanding the opportunities for learning. Finally, designing a larger meeting room in the visitor center will provide a space for community meetings, refuge activities, and other events and may help the refuge communicate with and connect with community members.

Adverse impacts:

This alternative may result some adverse impacts. One is that designing and maintaining additional interpretative trails and an environmental education pavilion would entail additional expenses and mean that those resources cannot be used for other purposes. Likewise, hiring additional staff for visitor services is an expense that may be supported by some, but not by all. Constructing a trailer pad, and designing a larger meeting room have the same negative impacts-both will use resources that will not be available for use elsewhere at the refuge.

Another potential negative impact of this alternative is that increased interpretative trails, additional programs, and more building construction may damage resources or fragment habitats. Some visitors may also feel that increased signage results in sign pollution and detracts from the naturalness of the refuge. Those from the Ecological Preservation perspective and from the Wildlife First/Recreation perspective may be concerned about those potential impacts.

Impacts on Environmental Education and Interpretation from Alternative C

Beneficial impacts:

This alternative provides all of the benefits of Alternative B, and additional benefits. Opening the visitor center 7 days a week year round would provide maximum opportunities for visitation and may increase satisfaction with Refuge services. Constructing an environmental education pavilion on the Freeland Tract instead of on the Beall Trail would provide a different, more popular location for environmental education programs on the refuge.

Adverse impacts:

These are the same as those in Alternative B, with an additional adverse impact related to cost of funding a 7 day a week visitor center.

Impacts on Environmental Education and Interpretation from Alternative D

Same as Alternative B, except the closing of portions of commercial cross-country skiing and snowshoeing trails at White Grass may mean that the refuge would not be able to offer the same level of environmental education and interpretation programming during the winter at the White Grass location. With up to 5,000 visitors using these trails annually, the Service could lose some opportunities to educate a fairly large group of people.

Impacts on Outreach and Partnerships from Alternative A

Beneficial impacts:

The beneficial impacts of this Alternative related to outreach and partnerships are that using a variety of venues and forums to communicate with the public help Refuge staff develop relationships with a variety of individuals and groups. In the USGS evaluation, four out of the five perspectives suggested more frequent and open communication with Refuge staff and this may be viewed as a benefit by those stakeholders.

Adverse impacts:

The activities in this alternative will take time and effort that could be used for active Refuge management. The perspectives that advocate for more attention to refuge resources, particularly the Ecological Preservation perspective and the Traditional Wildlife Management perspective may believe that using resources for these outreach activities should not be a priority.

For those who support increased outreach, the suggested activities and methods may appear too direct and structured, with inadequate attention paid to how to integrate the Refuge staff into the community on an ongoing and informal basis.

Impacts on Outreach and Partnerships from Alternative B

Beneficial impacts:

In addition to Alternative A:

Holding an annual open house may improve relationships with the community and provide an opportunity for the refuge to interact with community members in an informal setting. This may provide mutual learning experiences.

Adverse impacts:

Same as Alternative A

Impacts on Outreach and Partnerships from Alternative C

Same as alternative B

Impacts on Outreach and Partnerships from Alternative D

Same as alternative B

Impacts from Staffing in Alternative A

Beneficial impacts:

Current staffing levels allow the refuge to stay within budget and do not require budget increases. The current staffing situation encourages local residents to volunteer at the refuge, thus becoming involved in the refuge.

Adverse impacts:

Current staff numbers are inadequate to perform all needed refuge functions. Low staff numbers means an over-reliance on a limited pool of volunteers. Some who participated in the USGS Q-sort exercise mentioned this over-reliance as a problem.

Impacts from Staffing in Alternative B

In addition to Alternative A:

Beneficial impacts:

Making temporary positions permanent would provide more certainty to refuge managers and to staff. Increasing staff would increase the refuge's capacity to perform its functions. Increasing staff would contribute to local employment and local economic development.

Adverse impacts:

Funding additional positions would require a larger refuge budget, and may use funds that could be used to support other refuge activities. Making positions permanent could reduce flexibility, should the refuge determine that other staff configurations better meet refuge needs.

Impacts from Staffing in Alternative C

Same as alternative B

Impacts from Staffing in Alternative D

Same as alternative B

Impacts from the RNA in Alternative A

The RNA is not included in this alternative.

Impacts from the RNA in Alternative B

Beneficial impacts:

In this alternative, 754 acres of the refuge’s central wetland complex will be designated as the Blackwater Research Natural Area (BRNA). This designation will be considered beneficial primarily by those who support the Ecological Preservation perspective. Those in this perspective highly valued statements such as “The Refuge plays an important role in conserving, restoring, and protecting wetlands,” and “Wetland protection should be the driving force in determining access.” The Ecological Preservation perspective did not agree with the statement “Increasing access is more important than ecosystem health.” The focus on ongoing research in the BRNA may be considered a beneficial impact to those who place value on scientific investigation, and those who promote the use of science to inform management decisions.

Those holding the Wildlife First/Recreation Second perspective may also consider the BRNA designation beneficial, as evidenced by high agreement on these statements: “Watershed and habitat protection are primary concerns,” “Land acquisition to support management goals is important,” and “Reasonable access is acceptable, as long as resources are protected.” Other perspectives, particularly the Economic Development perspective, recognize the importance of wetland protection and value the role the refuge plays in that protection, but may be less supportive of the RNA designation because of the high value those perspectives place on access for a variety of purposes.

Adverse impacts:

The BRNA designation will curtail some hunting access, and this will be considered an adverse impact by those who desire access for wildlife dependent recreation. Deer hunting will continue to be permitted in the BRNA, but hunting of other species will be eliminated. This may be considered an adverse impact by those who hunt species other than deer. Those in the Economic Development perspective, while agreeing that the refuge plays an important role in wetland protection, also agree that access should be increased, so the access restrictions of the proposed BRNA may be viewed as a negative impact.

Impacts from the RNA in Alternative C

Beneficial impacts:

In this alternative, the BRNA would be reduced in size to 593 acres. The beneficial impacts are likely to be the same as those in Alternative B, but the magnitude of the benefits may be reduced if ecologically important areas are not included in this smaller Research Natural Area.

Adverse impacts:

The reduced size of the BRNA in Alternative C is intended to reduce the negative impact of limiting hunting on the refuge. Thus, this adverse impact is likely to be diminished in magnitude. Adverse impacts on recreational hunter access may likewise be reduced, but even with the smaller acreage hunting for species other than deer in this area will be eliminated and that is likely to be viewed as a negative impact by those supporting the Traditional Wildlife Management and Economic Perspective.

Impacts from the RNA in Alternative D

Same as alternative B, but the RNA will be larger, so there will be more of the beneficial and adverse impacts as described in alternative B.

Effects on Upland Habitats

The forested, scrub-shrub, and grassland habitats of the refuge provide diverse habitat components to support breeding birds and other wildlife. We evaluated the benefits and adverse impacts of the management actions under the four alternatives on forested and upland habitats. We considered the benefits from:

- acquiring and conserving forested and upland areas within the refuge's acquisition boundary.
- allowing natural succession in existing forested areas.
- maintaining and increasing early-successional habitats.
- allowing natural succession on existing grassland areas.
- continuing partnerships to maintain early-successional habitat and restore red spruce and balsam fir habitat.
- white-tailed deer hunting program.

We considered the potential for adverse impacts from:

- mowing, cooperative haying, burning prescribed fires, potential grazing, and applying herbicides to maintain grasslands.
- allowing natural succession to deplete or eliminate grassland or scrub-shrub habitats.
- maintaining trails and increasing trail miles for public use in areas where threatened and endangered wildlife species are known to occur.
- forest management activities that include tree cutting and use of logging roads and skid trails.
- increased recreational use of uplands that could lead to habitat impacts or wildlife disturbance.
- allowing dispersed use on 2,330 acres where rare plant communities and species are known to occur and threatened and endangered species may occur.

Impacts That Would Not Vary by Alternative

Regardless of the alternative selected, we use standard and effective habitat management techniques to conduct forest, shrubland, and grassland management activities in the refuge uplands. These best management practices (BMPs) would protect sensitive habitat components such as vernal pools and focal species nesting sites. Whenever practicable, we will replace non-native plant species with native species to restore the ecological integrity of the refuge.

The refuge will use certain tools to help maintain, enhance or create wildlife habitat:

- replanting with native species.
- prescribed fires.
- haying/mowing.
- applying herbicides.
- hydroaxing and use of heavy equipment for tree removal or construction activities.

Rare Plant Communities—Regardless of alternative, we would take measures necessary to protect and enhance rare upland plant communities on the refuge.



Ken Sturm/USFWS

Red spruce stump

Invasive Plants—Invasive plants if allowed to establish and spread can cause damage to native plant assemblages and the wildlife they support. We would take steps to ensure that invasive species do not become established to degrade upland habitats by monitoring for invasive species and treating them where they occur. Key among these invasive species on uplands, although sporadic in distribution, is multiflora rose, Japanese stiltgrass, garlic mustard, and Japanese barberry. We would take proper care in cleaning and maintaining all refuge equipment to avoid introduction or transport of invasive plants, implement visitor outreach and education programs, and actively support state initiatives and continue to work with the state to prevent introduction of invasive species to all habitats on the refuge.

Impacts from hunting—In all alternatives, we will offer a hunt program that includes the harvesting of white-tailed deer. As we attempt to strengthen the integrity of the forests, shrubland, and wetlands on the refuge, controlling the white-tailed deer population is imperative. When white-tailed deer are overpopulated, they over-browse their habitat, which changes habitat structure and plant composition. Flaherty (2006) found that Jacob's ladder, a state species of concern and listed as globally rare, in addition to other rare plant species, is experiencing heavy browse damage on refuge land. Over-browsing can stunt the growth of young tree seedlings (1–9 years old) and lead to local extirpation of the tree species. Failure to control the white-tailed deer population would have negative impacts on forested habitats and, therefore, on future resident and non-resident wildlife populations as well as the purpose of the refuge. For more information on beneficial and adverse impacts to uplands from white-tailed deer management refer to rationale discussions under alternatives A and B in chapter 3, and the Hunt Program Environmental Assessment.

Impacts from increased visitation—All alternatives predict some increase in annual visitor numbers based on improvements to visitor infrastructure and increased opportunities for wildlife observation and photography. Alternative A predicts the lowest annual increase, since no additional infrastructure is proposed, while alternative C predicts the highest increase because it focuses on maximizing visitor use on the refuge.

Impacts on wildlife—Protecting and managing current refuge land and acquiring land from willing sellers within the refuge acquisition boundary would generally benefit all wildlife species that use forest, shrubland, and grassland habitat for a portion of their life cycle.

Direct impacts on wildlife can be expected wherever humans have access to an area. In general, human presence disturbs most wildlife, which typically results in a temporary displacement without long-term effects on individuals or populations. Some species will avoid areas frequented by people, such as developed trails and buildings, while other species, like brown-headed cowbirds, have been known to use trails and roads as vectors for invasion which adversely impacts other wildlife species. When visitors approach too closely to nests, they may cause the adult bird to flush exposing the eggs to weather events or predators. Overall, direct effects should be minimal from non-consumptive visitor activities because current use of refuge lands is dispersed, the trail system is established, and large areas of the refuge are not accessible by trail. Furthermore, off-trail access is allowed only by special use permit, therefore limiting its impacts on wildlife. A more detailed discussion on visitor use and impacts to wildlife can be found in “*Effects on Public Use and Access.*”

Habitat management activities, such as mowing, using prescribed fire, and using silvicultural practices would likely result in the inadvertent take of a small number of invertebrates, small mammals, reptiles and amphibians, and breeding, wintering, or migrating birds. It may also cause temporary disturbance or displacement of other species. However, management activities would cause no major mortality or loss in local populations, because actions occur on a rotational basis, meaning no major habitat components would change completely in any one year. Additionally, management actions for early successional woody habitat and grasslands would be conducted after the breeding season for migratory birds, thereby avoiding direct impacts to nesting and recruitment.

Continuing red spruce and balsam fir restoration would provide long-term benefits, outside the 15-year scope of this plan, to Cheat Mountain salamanders and West Virginia northern flying squirrels. Increases in overall acres of high elevation northern hardwood/spruce-fir habitat would enhance and expand existing habitat for Cheat Mountain salamanders and flying squirrels. This upland cover type has been identified as a key overstory component associated with populations of Northern flying squirrels (USFWS 1990, Ford et al. 2004).

Impacts to Endangered and Threatened Species—Regardless of alternative, there would be impacts to federally threatened Cheat Mountain salamanders and federally endangered Indiana bats from management activities on uplands. For alternative B, consultation with the Service’s West Virginia Field Office (WVFO) concluded that proposed actions were not likely to adversely affect threatened or endangered species on the refuge. A detailed discussion on impacts to endangered and threatened species can be found in the “Impacts to Endangered and Threatened Species” section.

Impacts to forested wetlands and aspen woodlands are discussed in “Effects on Freshwater Wetlands.” While strategies relating to this habitat type are discussed in Chapter 2 and 3 within the context of uplands, management actions are more likely to beneficially and adversely affect wetlands plants, soils, and wildlife species.

Impacts of Alternative A (Current Management)

All Upland Habitats

Benefits

Under alternative A, we would continue to manage and protect the refuge’s current 10,482 acres of northern hardwood forest, conifer spruce/mixed forest, shrublands and old fields and grasslands. All upland habitat types would benefit from the harvest of white-tailed deer; however, alternative A provides the least benefits to habitats from white-tailed deer harvest on the refuge.

Adverse Impacts

Over the long-term, vegetation and wildlife associated with upland habitat would be affected by increased visitor usage and trail use. For a detailed discussion on impacts to wildlife and vegetation see “Impacts to Public Use and Access from alternative A.”

Northern Hardwood Forest and Conifer Spruce/Mixed Forest

Benefits

Under alternative A, we would continue to protect and manage the refuge’s current 6,616 acres of northern hardwood and conifer spruce/mixed forest. Because we would not use silvicultural practices to actively manage forests, there would be no impacts from tree cutting or construction and use of logging roads and skid trails. Benefits from alternative A are the same as those discussed in *Impacts to Upland Habitats that would not vary by Alternative*.

Beneficial impacts to West Virginia northern flying squirrels and Cheat Mountain salamanders are the same as discussed in “*Impacts to Upland Habitats that would not vary by Alternative*.”

Adverse Impacts

Adverse impacts from alternative A are the same as those discussed in *Impacts to Upland Habitats that would not vary by Alternative*.

Shrubland and Old Field

Benefits

The Service has approximately 853 acres of shrubland and 2,482 acres of old field habitat and currently manages 35 acres in alternative A to benefit wildlife species that depend on that habitat type, like migratory songbirds and American woodcock.

Adverse Impacts

Shrubland restoration would directly and negatively impact grassland breeding birds. However, some fields provide only marginal grassland habitat and have been found to have a rapid succession rate best suited to shrubland habitat. In addition, the refuge provides and manages 531 acres of grassland habitat in larger habitat blocks providing breeding and stopover opportunities for migratory songbirds and waterfowl.

Managed Grasslands

Benefits

Continuing to manage up to 531 acres of grasslands on the refuge will help sustain its role in contributing to maintaining grasslands in the region overall and to the biodiversity that type represents. Managing grasslands on a rotational basis would provide a habitat mosaic benefiting multiple wildlife and plant species and provide herbaceous cover for breeding and migrating birds.

Adverse Impacts

We would follow best management practices for prescribed burns, haying and mowing, and other practices that could affect grassland soils and cause localized habitat damage. The Service will adhere to detailed burn plans to ensure that those risks remain low. We take strict precautions in applying herbicides to ensure that they affect only the targeted plants. Long-term management to promote the habitat would offset any localized, short-term, adverse effects.

**Impacts of Alternative B
(Focal Species Emphasis)**

All Upland Habitats

Benefits

We propose to greatly expand conservation of upland habitats at the refuge and to institute a wide range of significant upgrades in our management of upland focal species under alternative B. We would continue to conserve and manage the refuge's current 10,482 acres of upland forests, shrublands, old fields, and managed grasslands under alternative B. Beneficial impacts to upland habitats would increase in alternative B in comparison to alternative A, through increased management and restoration and increasing white-tailed deer harvest on the refuge and potentially on adjacent lands. Under alternative B, the refuge would increase hunting in remote areas by implementing a limited shuttle service to assist with white-tailed deer extraction, encourage cooperative hunts with adjacent landowners, and modify "no rifle zones" to allow more rifle hunting. Using these measures the refuge anticipates increased harvest of white-tailed deer would have long-term beneficial impacts to upland plant communities. There would be adverse impacts, like trampling of vegetation during hunting activities, associated with hunting but the benefits to refuge habitats far outweigh any adverse effects.

Adverse Impacts

Adverse impacts to uplands would increase in alternative B in comparison to alternative A, with an increase in the number of trails, trail miles, visitor infrastructure, and increased estimated visitor use. Construction and maintenance of trails would occur in uplands resulting in the direct loss of upland habitat acres; however, restoration of logging roads, skid trails, and riparian areas would offset any net loss of uplands.

Northern Hardwood Forest and Conifer (Spruce) /Mixed Forest

Benefits

Alternative B would implement specific measures to enhance conifer spruce/mixed forest habitats to benefit blackburnian and black-throated blue warblers, fishers, Saw-whet owls, recently de-listed West Virginia northern flying squirrels, and federally threatened Cheat Mountain salamanders. Management activities that would beneficially impact forest stands and wildlife habitat include the use of silvicultural methods to enhance conifer spruce/mixed forest habitats and to convert forest islands and edges to early successional habitats. In spruce-fir management units thinning, girdling, single tree or group selection cuts of up to one-half acre in size with cutting cycles of 15 to 20 years, and reserved shelterwood cuts will be used. In forest islands and edges, the refuge proposes using group selection cuts, clear cuts, and patch cuts up to 15 acres in size annually on a 15-20 year rotation.

Silvicultural practices would be used to convert forest islands and edges to early successional habitats beneficially impacting species like American woodcock and Eastern towhee. Early-successional habitats on the refuge have been identified as being locally and regionally significant to birds within BCR 28. Increasing acreage of this habitat type would contribute to achieving population objectives for these species.

Logging road obliteration, recontouring, and revegetation would provide long-term benefits by reconnecting fragmented forest blocks and increasing the overall acreage of forest stands. Increasing acreage of contiguous forested habitat through acquisition of forested lands and reducing forest fragmentation will benefit area-sensitive forest plant and animal species (Robbins et al 1989; Betts et al. 2006; WVDNR 2006; Semlitsch et al. 2007).

Additional benefits to rare plant communities would be expected in alternative B with the enlargement of spruce stands through planting, providing long-term benefits, outside the 15 year scope of this plan, to Cheat Mountain salamanders and northern flying squirrels by increasing and improving available habitat.



Ken Sturm/USFWS

Spruce and foliage

Adverse Impacts

Dependent of the scale of silvicultural improvements there is some risk of causing adverse impacts, on, adjacent to, and downslope of the site as well as on access roads and skid trails. Forest practices using heavy equipment could damage the litter layer, coarse woody debris, snags, or cavity trees important for wildlife. They may alter the moisture regimes in soil and on the forest floor in ways that affect plants and animals such as forest floor amphibians and small mammals (Carey and Johnson 1995, Petranka et. al. 1993). Other potential effects include soil disturbance, compaction, and erosion on site and on access roads and skid trails, elimination or displacement of individual animals inhabiting the treated site, loss of nesting, roosting, or raptor perching trees, and increased risk of colonization by invasive plants and animals. The refuge would minimize adverse impacts by hand-carrying in chainsaws to forest stands rather than using heavy equipment and leaving cut plant material in place to increase coarse woody debris for forest amphibians, invertebrates, and small mammals. Best forest management practices would be followed to ensure that any effects on managed land would be minimized. In addition, forest stand improvement methods will be described in detail in the Refuge's Forest Management Plan.

There will be short-term adverse impacts to soils, hydrology, and adjacent habitats associated with logging road obliteration, recontouring, and revegetation efforts. Adverse impacts would be minimized through best management practices. These short-term impacts would lead to substantial long-term benefits by increasing

available habitat and restoring habitat functionality in areas where logging roads have fragmented habitat and are contributing to downslope erosion and sedimentation.

Adverse short-term impacts would be expected from erecting white-tailed deer exclosures on the refuge. Because the refuge has not targeted specific sites for these exclosures, a range of expected impacts are likely to occur. If the exclosures are close to existing roads and trails, impacts to soils, hydrology, and plant communities will be minimized. If the exclosures are built away from existing infrastructure, impacts to soils, hydrology, and plant communities will be greater. In order to erect the exclosures the use of a skidsteer may be required to drive auger holes for post placement. The refuge would minimize impacts to soils, hydrology, and plant communities from the use of heavy equipment by placing rubber mats over sensitive wetlands to minimize impacts from tracked vehicles, operating tracked vehicles when wetland soils are firm, and following best management practices listed in the Habitat Management Plan.

Shrublands and Old Field

Benefits

Benefits to shrublands would increase in alternative B as this alternative proposes to manage 853 acres of shrubland and old field habitat, which is an increase of 535 acres from alternative A. Contributing to this increase are 216 acres of previously managed grasslands that would be managed as shrubland and old field habitat. American woodcock and early successional focal species would benefit most under alternative B from management efforts to maintain singing ground habitat and increase shrubland habitat acres by allowing succession to occur on 2,482 acres of old fields including 216 acres of managed grasslands.

The demonstration area would increase awareness and support of management activities on the refuge. By providing visitor viewing opportunities and interpretation, visitors would be able to view changes in plant communities and wildlife response to management actions over time. In turn this would increase understanding of the importance of shrubland vegetation and wildlife communities not only within Canaan Valley but also regionally.

Manual or portable power tools would be used in vegetation management to manipulate or maintain habitat such as alder. Cutting would be conducted after the breeding season of most birds and when disturbance to foraging wildlife would be minimized. The use of grazing animals is being considered in the demonstration areas as a tool for managing vegetation under hawthorn communities. Goats have been used to reduce woody vegetation encroachment and cattle are effective in herbaceous vegetation management. Prescribed grazing can also be effective to reduce invasive species cover if applied correctly. Walker et al (1994) note that goats were effective in managing leafy spurge in confined area trails. Refuge management of grazers would be similar in that areas would be tightly restricted to habitat management blocks. As these areas would also be research demonstration sites, the effects would be closely monitored and evaluated for success in meeting vegetation management objectives.

Adverse Impacts

Adverse impacts from alternative B include impacts from mowing shrub communities on a two to four year rotation and experimental cutting of alder stands for alder regeneration. Localized adverse effects from mowing include soil compaction and rutting where wet soils are encountered, damage and loss of vegetation, displacement of foraging wildlife, inadvertent take of small mammals, reptiles and amphibians, and young birds. The refuge would minimize these potential adverse effects by performing management actions after the bird breeding season, when plants are dormant, and when small mammals, reptiles, and amphibians are least active. The refuge would follow best management practices to minimize soil damage and loss of vegetation.

The refuge will minimize adverse impacts from alder cutting by using manual or portable power tools to manipulate alder stands. Other shrubland management would be conducted with rotary mower equipment when necessary. Cutting would be conducted after the breeding season of most birds and the refuge would minimize disturbance to foraging wildlife. In addition, the long time interval between cutting rotations for shrub communities (alder stands -20 years) would further minimize adverse effects.

Prescribed grazing would require the construction of either temporary or permanent fencing to contain animals within the desired upland management unit. Fence failure and/or animals escaping from intact fenced areas could negatively affect habitat adjacent to prescribed grazing management units.

Escaped animals grazing in wetland areas could cause soil erosion, plant trampling, and stream sedimentation if they are able to access riparian areas. Additionally, disproportionate impacts to plant species and communities could occur if grazing occurred un-checked in wetland areas as many species and plant communities in wetlands are considered rare in Canaan Valley.

Grazing impacts in riparian habitats have been found to impact water quality (Pinay et al. 1992), reduced vegetative structure important for avian richness and diversity (Popotnik and Giuliano 2000, Saab et al. 1995). Small mammal populations in heavily grazed areas are found to change from species associated with niche habitats to those requiring little vegetative cover and more general diets (Johnston and Anthony 2006). To address these potential impacts the refuge would ensure that fence construction and maintenance was appropriate for containing the animals being used for the prescribed grazing activities. Grazing areas would be located in uplands and water sources would be provided to eliminate the need for animals to seek riparian habitats. The duration of time required to achieve the vegetation objectives within the management unit would likely be short, therefore further reducing the likelihood of escaped animals or fence failure.

Managed Grasslands

Benefits

Alternative B proposes to manage 315 acres of grassland habitat, which is a 41% reduction in managed grassland habitat from alternative A. The refuge proposes to reduce interior grassland fragmentation by removing fence lines and tree rows. Expected benefits from these actions are a decrease in edge effect, a decrease in predation rates on grassland nesting songbirds, and an increase in contiguous grassland habitat. In addition, the refuge would work with adjacent landowners to improve private grassland habitat through education and outreach that would encourage late haying and mowing, development of conservation easements, and incentive programs. Delayed haying and mowing on farmlands off the refuge might achieve an overall positive effect on grassland bird reproduction in Canaan Valley. In addition, increasing overall grassland acreage through conservation easements would further the refuge's efforts in grassland conservation.

Adverse Impacts

In this alternative, the refuge would not manage grasslands smaller than 50 acres, unless needed to support an administrative or priority public use. Those fields would revert to shrub habitat over the next 15 years. Their loss to succession would be considered adverse to the overall objective of maintaining the grassland type, but that impact would be negligible when considered in the context of the more focused management of grasslands in larger contiguous areas in this alternative. On the other hand, focusing management efforts and improving vegetative structure and composition on larger grassland fields might be more beneficial to area sensitive grassland dependent species. Many studies have found a link between small field size (<50 acres) and an increase in predation rates of grassland songbird eggs and fledglings. Actively managing small, fragmented grassland habitats may be detrimental to grassland songbird reproductive success and not contribute to their population objectives. The refuge would manage a variety of grasslands in various successional stages to provide cover and foraging opportunities for breeding grassland songbirds and migratory land birds.

We would follow best management practices for prescribed burns, haying and mowing, and other practices that could affect grassland soils and cause localized habitat damage. Long-term management to promote the habitat would offset any localized, short-term, adverse effects.

**Impacts of Alternative C
(Maximize Public Use)**

Benefits

Under alternative C, the refuge would continue to conserve the refuge's current 11,262 acres of upland forests, shrublands, old fields, and managed grasslands. Under alternative C, beneficial impacts from the harvesting of white-tailed deer are similar to alternative B.

Adverse Impacts

Under alternative C, adverse impacts from the harvesting of white-tailed deer are similar to alternative B.

Short-term and long-term adverse impacts to uplands are greater in alternative C than in the other alternatives. Long-term adverse impacts from increased visitor infrastructure and construction projects and increased trail construction would create an irreversible loss of upland habitat. There would be no loss of upland habitat from the potential Camp 70 road improvement, although increased vehicle access and associated human use could create some long term impacts to upland habitats adjacent to the road.

Off-trail use within a zoned area would likely cause adverse impacts to upland plant communities and wildlife. Impacts might be minimized as users would be spread over a large area; however, it will be difficult for the refuge to locate, monitor, and perform remediation measures on impacted plants due to unpredictable visitor use and spatial extent of the off-trail use zone. Upland soils associated with steep slopes have the potential to be severely impacted by dispersed use activities (Bell 2002, Rizzo 2002).

The refuge will minimize impacts by issuing no more than 25 special use permit per month for dispersed use, and by only permitting off-trail use during the hunting season. By issuing special use permits the refuge would be able to gather information on the number of users, gather information on the days and duration of use, and restrict location of use as necessary to minimize resource impacts. This information would enable the refuge to monitor known locations of dispersed use for damage and perform remediation measures as needed. For additional information on the impacts related to the off-trail use zone see "*Effects of Public Use and Access, Public Use and Access Impacts from Alternative B.*"

Northern Hardwood Forest and Conifer Spruce/Mixed Forest

Benefits

Benefits to northern hardwood forests and conifer spruce/mixed forests are similar to alternative B, although alternative C will rely on increased harvesting of white-tailed deer for forest stand regeneration. There would be no damage to forest stands related to silvicultural operations; however, overall benefits to forest stands from alternative C are far lessened because forest stands would not be managed strategically. In areas where extensive logging has occurred forest stands would not benefit from forest stand improvement measures identified in alternative B.

Adverse Impacts

Red spruce that persist in the understory would be adversely affected under alternative C. Because red spruce is tolerant of shade, it can persist and grow slowly in the understory for up to 100 years and respond to release as

surrounding trees die. However, the longer red spruce is suppressed in the understory the longer it will take to recover from a release, which may allow other faster-growing species to outgrow it. Many of the stands with a red spruce component in the understory are 70 to 90 years old. The red spruce that is in the understory most likely has been suppressed during this time. Since a release is not planned in most of these passive restoration areas, it is likely that much of the red spruce in the understory will die within the next 10 to 30 years. Overall, the range of red spruce would continue to expand toward pre-20th century conditions but at a much slower rate than in the other alternatives (Monongahela National Forest EIS 2008).

Habitat improvements for Cheat Mountain salamanders and northern flying squirrels would not be achieved within the 15 year scope of the CCP under this alternative. Benefits to these species would be long-term in alternative C, while strategic red spruce and balsam fir restoration in the other alternatives would be expected to expand habitat acres within the understory and in forest openings within the scope of this CCP.

Shrubland and Old Field



Steve Hildebrand/USFWS

White-tailed deer

Benefits

Under alternative C, the refuge would manage 853 acres of shrubland habitat, which is the same as alternative B. Alternative C proposes to add an additional demonstration area in comparison to alternative B. The benefits from these demonstration areas are described in the *Impacts to Upland Habitats for Alternative B, Northern Hardwood Forest and Conifer Spruce/Mixed Forest, Shrubland and Old Field section*. Alternative C provides an added benefit by increasing viewable area and exposing visitors to varying early successional habitat restoration techniques by having two viewable demonstration areas. This increased viewing opportunity has the potential to increase levels of disturbance to associated wildlife.

Adverse Impacts

We would follow best management practices for mowing, and other practices that could affect soils and cause localized habitat damage. Long-term management to promote the habitat would offset any localized, short-term, adverse effects.

Managed Grasslands

Benefits

Under alternative C, the refuge proposes to manage 341 acres of grassland habitat. This is more acreage than proposed in alternative B, but 190 acres fewer than alternative A proposes to manage. Adverse impacts to grasslands are the same as those discussed in alternative B.

Adverse Impacts

We would follow best management practices for prescribed burns, haying and mowing, and other practices that could affect grassland soils and cause localized habitat damage. Long-term management to promote the habitat would offset any localized, short-term, adverse effects.

Impacts of D (Focus on Managing for Historical Habitat)

All Upland Habitats

Benefits

The refuge would continue to conserve the refuge's current 10,482 acres of upland forests, shrublands, old fields, and managed grasslands. All habitats would be managed passively to eventually achieve late-successional forest characteristics. This approach would benefit northern hardwood forests and conifer-spruce forests but adversely impact shrubland, grassland, and old field habitats. Measures to increase white-tailed deer harvest on the refuge are similar to alternative B and C. If white-tailed deer harvest objectives are not met, the refuge would work with the state to increase deer hunting seasons and implement special antlerless hunts to meet harvest objectives. Of all alternatives, measures taken under alternative D would be the most beneficial to refuge plant communities by increasing the refuge's flexibility to control white-tailed deer populations to benefit plant communities and their associated wildlife.

Adverse Impacts

Adverse impacts from alternative D are similar to those discussed in "*Impacts of Upland Habitats from Alternative B.*" However, adverse impacts would not be as extensive because alternative D limits vehicle access (same as alternative A) and decreases trail miles as a result of trail closures or changes from proposed trail connections in alternative B. A reduction in public use activities would beneficially impact associated uplands.

Northern Hardwood Forest and Conifer Spruce/Mixed Forest

Benefits

Long-term benefits to forests on the refuge in alternative D would increase in comparison to alternative B from an increase in forested acres relating to succession of old field and grassland habitats over time. The succession of old field and grassland habitats would initially increase habitat for species like American woodcock, Eastern towhee, and brown thrasher. However, habitat for these species would decrease in the long-term (outside the scope of this plan) and benefit forest interior species like scarlet tanagers and eastern wood peewees as forested habitat acres increase.

West Virginia northern flying squirrels and Cheat Mountain salamanders would have long-term benefits, outside 15 year scope of this plan, from natural conversion of upland habitats to late-successional forests. As in alternative C, benefits to these species would occur outside the time frame of this CCP.

Adverse Impacts

The silvicultural practices employed under alternative D and their potential impacts, best management practices, and implementation of restrictions to conserve sensitive environments would be the same as alternative B.

Under alternative D, we would not create early successional habitat demonstration areas and would not promote early successional focal species. We would manage for natural clearings and early successional components in mixed stands that would be part of the mosaic of stand composition sought under this alternative. These clearings would benefit woodcock only if singing grounds and large openings for night roosting are sufficient in number and proximity to the woodcock's other necessary habitat components to adequately support breeding and migration requirements of the species.

Shrubland and Old Field

Benefits

In contrast with the other alternatives, which propose to actively manage for early successional habitats, alternative D proposes to allow natural succession to take place on all shrublands and old field habitats. Early successional species, like American woodcock, would receive short-term benefits related from succession but ultimately would be displaced as habitats continue to succeed to northern hardwood forest.

Adverse Impacts

As described above, there would be long-term adverse impacts to shrubland dependent species on the refuge related to eventual displacement and these species will only be able to utilize early successional habitat where they naturally occur. Early successional habitats would slowly (> 50 years) revert to later successional forested types which would all occur well outside of the 15 year time frame of this CCP. The displacement of early successional bird species may adversely affect local and regional population goals set by the BCR as the refuge under alternatives A, B, and C provides habitat that is scarce in the region, state, and local area.

As the refuge shrublands and old fields succeed to forested habitat, certain populations of rare plant communities and plant species, like Glade Spurge in old fields, would possibly be adversely affected by reducing patch size and frequency of occurrence. However, the populations of these species are expected to persist over time within later successional woodland habitats. The refuge will minimize adverse effects to glade spurge populations by developing a management plan to ensure populations persist in refuge habitats.

Managed Grasslands

Benefits

Alternative D would provide the least benefits to managed grasslands on the refuge. In contrast with the other alternatives which propose to actively manage grasslands, alternative D proposes to allow natural succession to take place on all managed grasslands.

Adverse Impacts

Over time these grasslands would revert to shrubland and forested habitat. There would be long-term adverse impacts to grassland dependent wildlife species. However, these impacts would not be immediate but would be observed within the 15 year duration of the plan. Unmanaged grasslands, through changes in vegetation type and structure, would become less desirable to grassland dependent wildlife species and eventually would displace them entirely. Although grasslands may continue as a varying component due to natural disturbance on the refuge its part in sustaining grassland habitats in the region would diminish accordingly. Grassland breeding songbirds, as an example, would seek suitable breeding sites elsewhere. Some grassland birds would likely set up breeding territories on active farmlands, particularly active hayfields in Canaan Valley, to continue nesting. Haying operations on neighboring lands typically take place at the height of the grassland bird breeding season and would lead to the loss of nests, nestlings, and fledglings. While species like Henslow sparrows would benefit in the short-term from active grasslands reverting to idle, old fields, Canaan Valley would likely lose these grassland- and area-dependant species within 10 years. While grassland dependent species would be adversely impacted, the Service believes the benefits to priority migratory species of concern that utilize shrubland plant communities and the succession to more historic, naturally occurring habitats far outweigh these impacts.

Effects on Freshwater Wetland Habitats

There are four fields (Freeland, Thompson, Harper, and Beall) that were ditched and drained to create pastures and hayfields prior to refuge acquisition. Alternative D proposes to plug those ditches and restore wetland characteristics to those fields. Native wetland plant species would benefit because they would out-compete planted grasses and most non-native plant species that are not suited to wetland soil types or inundation.

Wetlands management and conservation is our highest priority for the refuge, consistent with the original refuge establishment purpose, and our first and foremost CCP goal. We evaluated the management actions proposed for each of the refuge CCP alternatives for their potential to benefit or adversely affect open water and wetland habitats—including shrub and herbaceous, forested, aspen woodland, and open water-and associated focal species.

Benefits

We evaluated the benefits of our actions that would conserve or restore the open water and wetlands habitats or conserve and enhance breeding or migrating focal species, including:

- Acquisition and conservation of additional wetlands.
- Conversion of certain areas to more productive or unique wetlands.
- Management to prevent the spread of invasive species.
- Continuation of the refuge's hunting and beaver management programs to protect rare and sensitive plant communities and enhance habitat for the refuge's focal species.
- Establishing a RNA to preserve examples of major wetland ecosystem types, provide research and educational opportunities for scientists and others; and contribute to the preservation of genetic and behavioral diversity for native plants and animals.

Adverse Impacts

We evaluated the potential for the actions proposed under the Canaan Valley refuge management alternatives to cause adverse effects to open water and wetlands habitats, including:

- actions causing soil, hydrology, and water quality impacts that might adversely affect open water biota and wetlands maintenance and productivity.
- actions such as vegetation management like aspen stand cutting, that might adversely affect open water biota and wetlands maintenance and productivity.
- activities of refuge visitors that might directly impact wetlands habitats or disturb nesting or migratory species.
- activities in wetlands that could lead to impacts to rare plant communities and species.
- increased recreational use of wetlands that could lead to habitat impacts or wildlife disturbance.
- allowing off-trail use on 2,330 acres which include wetlands (4% that are wetlands) where rare plant communities and species are known to occur and threatened and endangered species may occur.

Impacts That Would Not Vary By Alternative

Regardless of which CCP alternative we select, we would continue to conserve the refuge wetlands as the highest priority for refuge management.

We expect that the Blackwater River watershed would remain largely protected in the foreseeable future and that only excessively prolonged periods of heavy rainfall or prolonged extensive drought, neither of which has been known to occur in this region, would alter the hydrologic regime.

Other than very gradual losses of acreage in particular wetland types resulting from natural succession, we anticipate that any adverse impacts to the refuge wetlands complex would likely be a result of changes in local hydrology or water quality originating within the Blackwater River watershed from direct human disturbance, the influx of invasive species, effects of climate change, and/or acid precipitation. Regardless of which CCP alternative we select, we would develop a Habitat Management Plan for wetland habitats, and would mitigate any potential for major unplanned changes in vegetation by continuously monitoring our vegetation types and updating our Geographic Information System database.

Rare Communities—Regardless of alternative, we would take all measures necessary to conserve rare wetland communities on the refuge.

Invasive Plants—Invasive plants if allowed to establish and spread can cause major damage to native plant assemblages and the wildlife they support. We would take steps to insure that invasive species do not become established to degrade the wetlands. We will monitor for invasive species and treat them where they occur. Key among these invasive plant species which currently occur in refuge wetlands are reed canary grass, multiflora rose, yellow flag iris, and cattails. We would take proper care in cleaning and maintaining all refuge equipment to avoid introduction or transport of invasive plants, implement visitor outreach and education programs, and actively support state and partner initiatives and continue to work with the state to prevent introduction of invasive species to all habitats on the refuge.

Impacts from hunting—The impacts are the same as those described for upland habitats in the discussion under “Impacts to Upland Habitats that would not vary by Alternative.” A more detailed description of beneficial and adverse impacts related to the refuge’s white-tailed deer hunt program is located in the refuge’s “Amended Environmental Assessment Hunt Program Proposal” (April 2007).

Impacts from furbearer management—Under all alternatives, our furbearer management program will only include beaver trapping as a management tool. The furbearer management program would not be designed to eliminate beaver, but rather, remove individuals in those areas where they are impacting sensitive and rare wetland plant communities and plant species of concern or refuge infrastructure. The removal of excess beaver from those areas would maintain furbearer populations at levels compatible with the habitat and with refuge objectives, and minimize beaver damage to plant communities and refuge roads and trails. Further, the trapping program is managed on an annual basis through issuance of special use permits which limit trapper numbers and locations on the refuge.

This program could result in both direct and indirect effects on open water and wetlands habitats and species. Indirect impacts could result from the activity of placing traps as it could disturb or displace migratory birds utilizing wetlands for wintering or foraging habitat during seasonal migrations. Direct impacts would include the harvest of targeted species, and the potential to harvest non-targeted species.



Ken Sturm/USFWS

Fall foliage

Because of the temporal separation of trapping activities and breeding wildlife using the refuge, indirect impacts on those resources by trappers would be negligible. Trappers using the refuge in late fall through early March may disturb individual early nesting waterfowl on occasion, and cause their temporary displacement from specific, limited areas. Those impacts are occasional, temporary, and isolated to small geographic areas.

Harvest of beaver can be both positive and negative. Beaver ponds at Canaan Valley Resort State Park appear to prohibit the movement of fish species, eliminate some lowland wetland plant communities, and could be partly responsible for the low dissolved oxygen levels in the Blackwater River. On the other hand, beaver ponds have been found to be beneficial to water quality and may help neutralize water with relatively low pH values before releasing it further downstream (Snyder et al 2006). Wetlands directly associated with beaver ponds have been found to harbor a diversity of rare plant species in Canaan Valley (Bonner et al 2009). Beaver are also a keystone species for cycling small wetland systems from pond to meadow to scrub-shrub to forest, and back to pond.

The accidental harvest of non-target furbearer species, such as river otter and mink, is possible, but requirements for trap setting, refuge regulations on size of traps and location of trap placement, requirements for a state license, outreach and education, and requirements for adherence to best management practices for trapping furbearers would help minimize impacts. Risk of taking species other than beaver will be reduced significantly as beaver trapping sets will occur specifically around areas of beaver activity. Selectivity for beaver can be achieved by carefully choosing trap locations, using specific beaver attractants, and employing trap types and trigger configurations that are unlikely to be sprung by other species. Trapper experience and the selection of the appropriate trap size will reduce non-target furbearer captures (Northeast Furbearer Resources Technical Committee 1996, Boggess et. al 1990). In particular, river otters are protected in the state of West Virginia. Currently the state provides trappers with recommendations on how to prevent the accidental take of river otters. This information will be made available to refuge trappers to help prevent accidental take. The Service will continue work with the state to help prevent the accidental take of river otter on the refuge through trapper education.

Under all alternatives, open water and aquatic wetland habitat would be adversely affected by anticipated decreases in their associated acres from beaver trapping. However, forested wetlands, aspen woodlands, and shrub and herbaceous wetlands and their associated plant communities and wildlife populations would be beneficially impacted by the refuge's beaver management program.

Impacts from increased visitation—In addition to impacts discussed in “*Effects on Public Use and Access*,” hunting and fishing are two priority, wildlife-dependent, consumptive activities with additional direct effects on open water wildlife and habitats. Hunting of waterfowl has been ongoing on refuge lands for decades, including prior to refuge establishment. The refuge's hunt program follows federal and state regulations for annual harvest levels and seasons by species. These regulations are set by the Service for each state based on what harvest levels can be sustained for a species without adversely affecting its overall Atlantic Coast flyway population. As such, hunting results in individual losses, but the projected cumulative harvest would not jeopardize the viability of any harvested species' population. Some disturbance to non-target wildlife species may occur; however, those impacts should be minimal because hunting pressure is low and occurs outside the breeding season.

The refuge's fishing program will follow the state of West Virginia regulations, including harvest limits for certain species. These limits are set by the state to ensure that harvest levels do not cumulatively impact native fish resources to the point they are no longer self-sustainable. Other potential impacts of fishing on open water and wetlands wildlife and habitats are detailed in the compatibility determination for public fishing found in appendix B, “*Appropriateness and Compatibility Determinations*.” A summary follows:

- *Accidental or deliberate introductions of non-native fish by anglers*—We plan to continue to work with the state in implementing a public education and outreach program; increased law enforcement is also planned under all alternatives.
- *Accidental introduction of invasive plants, pathogens, or exotic invertebrates attached to boats*—Similar to non-native fish, we will continue to work with the state in implementing a public education and outreach program under all alternatives.
- *Negative effects on waterfowl, wading birds, and other wildlife from lost fishing gear*—namely, the concern with these species ingesting lead sinkers, hooks, lures, and litter, or becoming entangled in fishing line or hooks. Similar to the threat from non-native fish, we will continue to work with the state in implementing a public education and outreach program under all alternatives.
- *Disturbance to wildlife; namely to breeding and brood-rearing waterfowl, bald eagles, and wading birds*—Similar to other visitors, anglers can approach too closely to nests, and may cause the adult birds to flush, exposing the eggs to weather events or predators. Under all alternatives we will continue to close areas seasonally around active nesting sites to minimize human disturbance.
- *Negative impacts on water quality*—These were described in the section titled “*Effects on Hydrology and Water Quality*” above.

- *Negative impacts on sensitive wetlands from boat access sites and associated foot traffic*—Direct impacts on vegetation can result from portaging boats over stream banks and through wetland vegetation. Other ground disturbing impacts can occur in wetlands from anglers getting their boats in water, or from shoreline fishing. Portions of, or whole plants, can be torn up, sometimes by the roots. Riparian soils may be especially susceptible to erosion when boaters have to portage around fallen logs in the river channel. Establishing and improving designated spots for boat access reduces this impact. Refuge boat access sites and trails will be located away from sensitive wetlands, peat lands, and rare plants under all alternatives. Boaters will not be permitted out of the river channel with the exception of necessary portaging around river obstructions. Habitat features important for trout, such as overhanging banks, will also be protected from disturbance.

Impacts on wildlife—Potential impacts to wildlife are the same as described in “Effects on Upland Habitats—Impacts that would not vary by alternative.”

Impacts to Endangered and Threatened Species—Regardless of alternative, there would be beneficial and adverse impacts to federally endangered Indiana bats from management activities in riparian and shrubland habitats. A detailed discussion on impacts to endangered and threatened species can be found in the “Impacts to Endangered and Threatened Species” section.

Service Activities—Wetlands may be at some minimal risk of indirect effects from Service activities in upland areas that drain into them from leaks or spill accidents involving chemicals or petroleum products in refuge management operations. Our leak and spill prevention and emergency clean-up procedures should ensure that such occurrences are rare, and are addressed immediately, limiting those short-term effects to the immediate location.

Impacts of Alternative A (Current Management)

All Wetlands

Benefits

We would continue to conserve the refuge’s current 5,573 acres of wetland habitat under alternative A. All habitat types would benefit from the harvest of white-tailed deer; however, alternative A provides the least beneficial impacts to habitats when compared to the other alternatives.

Adverse Impacts

Of the four refuge management alternatives, we would be most constrained under alternative A in terms of how we would improve conservation of wetlands and open water habitats and enhance management of focal species. Our management efforts would be limited to habitat inventory, mapping, and monitoring of impacted wetland areas, birds and other vertebrates, invertebrates, and plants. We would continue to implement active habitat management such as beaver trapping to protect rare plant communities. Other beaver ponds would persist to maintain open water habitats for associated plant and wildlife species.

Over the long-term, the risk of erosion and water quality problems that might affect these habitats would increase with increased visitor usage and trail use. Wetland complexes adjacent to active trails, like the Middle Valley trail and South Glade Run Crossing trails would be of particular concern as trail degradation from hiking, biking, and horseback riding could increase potential damage to associated wetlands. However the refuge makes every attempt to site trails in the least sensitive areas in order to minimize adverse impacts to wetlands and other sensitive community types.

Alternative A (as well as B and C) continue to permit raccoon hunting according to state seasons. Most raccoon hunting occurs in wetland areas and adjacent to access roads where hunters can deploy dogs. Therefore potential areas for wildlife disturbance are typically limited. Additionally the refuge will prohibit releasing dogs on Cortland Road and Old Timberline Road, in order to limit the potential of dog trespass on private lands. Cumulative impacts from disturbance may occur to wildlife if night hunting activities overlap with hunting or fishing activities in the same areas during the day. Raccoon season overlaps with most other hunting seasons and fishing occurs year round, therefore the potential for night time hunting areas corresponding to day use is high.

Because many raccoon hunters use dogs and hunt at night, raccoon hunting requires a special use permit. This allows the refuge to closely monitor hunting activity and deny permits to violators. Disturbance to non-target wildlife species is possible as a result of night hunting. Given that most mammal species are most active at night, and the length of raccoon hunting season, there is the potential encountering non-target wildlife during this activity. Due to the average low number of hunters participating in the refuge raccoon hunt and the ability of the refuge to limit hunting through special use permits; these impacts, if any, will be negligible. More information on the direct, indirect and cumulative effects of raccoon hunting are located in the 2007 Environmental Assessment for Hunting at Canaan Valley National Wildlife Refuge (USFWS 2007).

For additional adverse impacts relating to freshwater wetlands see *Effects of Hydrology and Water Quality, Impacts to Hydrology and Water Quality from Alternative A*.

Forested wetlands

Benefits

We would continue to manage and conserve the refuge's 347 acres of forested wetlands under alternative A. Cooperation with volunteers to plant red spruce and balsam fir seedlings would improve forested wetland habitat and increase overall acreage providing long-term benefits to associated rare plant communities and wildlife.

Adverse Impacts

There would be short-term impacts associated with spruce and balsam fir planting efforts as discussed in the Hydrology and Soils sections; however, impacts would be minimized by hand-carrying and hand-planting vegetation rather than using heavy equipment.

Forested wetlands – Aspen woodlands

Benefits

The refuge would continue to manage 114 acres of aspen woodlands within the 347 acres of forest wetlands under alternative A. Under alternative A, a diversity of wildlife species on the refuge would benefit in the short- and long-term from continued selective patch cuts in aspen management areas (Gullion 1984). Benefits from patch cutting include promoting aspen regeneration, increasing aspen stand acreage, and improving habitat for focal wildlife species like American woodcock and golden-winged warbler.

Adverse Impacts

There may be short-term adverse effects to wetland soils and hydrology, wildlife foraging and nesting, and plants associated with aspen stands during the patch cuts. However, the refuge would minimize impacts when possible by carrying in equipment on foot and using chainsaws rather than heavy equipment to cut targeted aspen stands.

Shrub and Herbaceous wetland

Benefits

We would continue to conserve the refuge's 5,060 acres of shrub and herbaceous wetlands under alternative A. Under alternative A, there are no management activities specific to the shrub and herbaceous wetland habitat type that beneficially or adversely affect this habitat type.

Adverse Impacts

Under alternative A, there are no activities specific to shrub and herbaceous wetlands that would adversely affect this habitat type. However, any adverse impacts discussed under the heading "*All Wetlands*" do apply to shrub and herbaceous wetlands.

Open water/aquatic habitats

Benefits

The refuge would continue to manage 85 acres of beaver pond system and 55 miles of stream under alternative A. As beaver pond systems are dynamic over time it is difficult to determine the extent of acreage associated with long-term management. Also in this alternative we allow public access to open water only from approved public use trails that intersect streams, corridors, or pond habitats. This access restriction minimizes disturbance to nesting waterfowl, breeding and migrating birds that use the more isolated beaver ponds and river habitats for nesting, feeding, and roosting areas. This will also allow for the natural succession necessary for the maintenance of the mosaic of plant communities to persist and develop.

Adverse Impacts

Under alternative A, the continuation of beaver trapping could adversely impact acreage of open water habitats. The benefits to rare plant communities and associated wildlife, however, outweigh any potential adverse effects associated with decreased open water acres.

Impacts of Alternative B (Focal Species Emphasis)

All Wetlands

Benefits

We propose to substantially expand conservation of the refuge wetlands and markedly upgrade how we manage for focal species under alternative B. We would continue to conserve the refuge's current 5,573 wetland acres. Among the alternatives, we would be best able to achieve our wetlands conservation and focal species management goals under alternative B. Our management efforts would be expanded well beyond our current management to include specific habitat manipulation and species conservation measures including broadening our techniques for white-tailed deer and beaver management, and management of habitat productivity for breeding and migratory birds.

Benefits to wetlands would increase under alternative B, in contrast to alternative A, through the remediation of impacted wetland areas. Unlike alternative A, which seeks to map and evaluate impacted wetland areas, alternative B seeks to restore natural wetland processes through remediation of impacted areas. In addition, wetlands in Canaan Valley would benefit from the designation of a 754-acre RNA and the development of an ecological integrity index that would serve to better understand, track, and improve wetland function and its role in providing for wetland-dependent wildlife species. The index would also be used to monitor changes in relation to climate change and restoration actions. The RNA, composed of 93% wetlands and 7% uplands, would

benefit wetland plant communities and plant species that are vanishing, rare, or restricted within their range by limiting human intervention and focusing on preservation.

Beneficial impacts to wetlands related to increases in hunting opportunities are discussed in the refuge's "Amended Environmental Assessment Hunt Program Proposal" (April 2007). Under alternative B, benefits to wetland plants would increase from additional hunting opportunities and increased access to remote areas for deer control.

Adverse Impacts

Alternative B has increased trail miles in comparison to alternative A that would lead to short-term adverse impacts to wetland communities from trail construction activities and long-term impacts from habitat loss where trails bisect wetlands and from trail maintenance activities. The refuge will use and improve existing logging and access roads when creating trails and will avoid wetlands whenever possible. Short-term, indirect, adverse impacts might be observed during upslope trail construction activities from soil erosion and sedimentation, and runoff from construction equipment and vehicles.

Construction of observation platforms, parking lots, and an environmental education pavilion will occur on upland soils. However, the environmental education pavilion will be constructed adjacent to forested wetlands and the Blackwater River. The refuge will adhere to best management practices for construction to minimize any adverse impacts to wetlands and the Blackwater River.

The construction of a boardwalk to connect Camp 70 loop trail to the Brown Mountain Overlook trail will create short-term direct impacts to wetlands through trail construction. No construction other than placement of boardwalk pilings would be done in wetlands so there would be short-term localized effects to hydrology and water quality during construction. However, by providing a connection across the wetlands, off-trail use would be prevented and subsequent impacts to hydrology and water quality would be mitigated.

We would continue raccoon hunting according to state seasons and current refuge regulations under alternative B. Anticipated effects are the same as alternative A. Adverse impacts to wetlands related to increases in hunting opportunities are discussed in the refuge's "Amended Environmental Assessment Hunt Program Proposal" (April 2007).

Forested wetlands

Benefits

Under alternative B, the refuge would continue to manage and protect 132 acres of mixed conifer forested wetlands of the 347 acres of forested wetlands. There would be long-term benefits from planting red spruce and balsam fir seedlings as this would lead to an increase in overall acreage for this habitat type and would improve the health of already existing stands. While erection of white-tailed deer exclosures might cause short-term adverse impacts to soils and hydrology during construction, the exclosures would protect seedlings and associated rare plant communities from white-tailed deer browse. This would ensure an increase in seedling survival rates and provide a long-term benefit of increased red spruce and balsam fir stand acres, which far outweighs any short-term adverse effects.



Indiana bat

Indiana Bats—Riparian restoration would increase foraging opportunities for Indiana bats. A detailed discussion on impacts to Indiana bats can be found in the “*Effects on Endangered and Threatened Species, Impacts to Endangered and Threatened Species from Alternative B.*”

Adverse Impacts

There would be short-term adverse impacts from planting of red spruce and balsam fir seedlings and erecting white-tailed deer exclosures as discussed above.

The refuge would minimize any short-term adverse effects associated with planting seedlings by hand-carrying plant material and equipment where appropriate. If additional equipment is necessary, best management practices would be used to minimize adverse impacts. The construction of white-tailed deer exclosures would include the use of a skidsteer vehicle in some locations. If construction occurs on hydric soil types, short-term adverse impacts would be expected from soil compaction and erosion. The refuge would take care to limit the extent and duration of use of heavy equipment in wetter soil types to minimize any adverse impacts. Additional measures to protect wetland soils and plants include placing rubber mats over wetlands to minimize impacts from driving skidsteer vehicles.

Forested wetlands – Aspen woodlands

Benefits

Under alternative B, 114 acres of aspen woodlands would be managed for early successional habitat within the 347 acres of protected forested wetlands on the refuge. No more than 20% of the 114 acres would be managed within the 15 years of the CCP. One key management tool for aspen stand management is the success of beaver population management in areas adjacent to aspen management areas. Aspen management areas would be beneficially impacted by controlling beaver in areas where successional aspen stands are a focus. Managing the beaver population in close proximity to these aspen stands would reduce damage and loss of regenerating aspen thickets with the short- and long-term benefits of continuing to provide additional cover for focal species, like American woodcock, and perpetuation of rare plant communities associated with the aspen cover type. The refuge will develop a habitat management plan for aspen stand management.

The benefits from demonstration site establishment are listed above with the added benefit of improving relationships with partners, increasing awareness and education of importance of early-successional habitat types, and improving management of forested wetlands and aspen woodlands.

Adverse Impacts

There is some risk that aspen stand management and establishment of demonstration sites would cause short-term localized impacts on these habitats from prescribed burning, use of heavy equipment such as a hydro-axe, and other forest management practices. In hydro-axing, wide rubber tires distribute the equipment weight to help minimize compaction. Hydro-axing may be done at sites with saturated soils, but the refuge will follow best management practices to minimize wetland soil disturbance such as conducting operations during winter months when the ground is frozen. The refuge will minimize adverse effects by using hand crews and chainsaws to perform forest management where appropriate.

Aspen woodlands would also experience direct, adverse impacts from acreage loss in areas where passive management would lead to succession of these stands. Because these aspen stands are expected to succeed to globally rare conifer woodland types, the overall benefit to the wetland system outweighs the loss of the more common early succession aspen woodlands.

Shrub and Herbaceous wetland

Benefits

We would continue to conserve the refuge's 5,060 acres of shrub and herbaceous wetlands under alternative B. Under alternative B, forest management techniques will be implemented to improve habitat quality for Indiana bats. For additional information on impacts to Indiana bats see "*Effects on Endangered and Threatened Species, Impacts to Endangered and Threatened Species from Alternative B.*"

Adverse Impacts

Under alternative B, there are no management activities specific to shrub and herbaceous wetlands that would adversely affect this habitat type. However, any adverse impacts discussed under the heading "Impacts to Freshwater Wetlands from Alternative B - All Wetlands" do apply to shrub and herbaceous wetlands.

Open water/aquatic habitats

Benefits

Under alternative B the refuge will continue to manage 85 acres of open water habitat and 55 miles of riparian habitats. Open water habitats are dependent upon fluctuating beaver populations which the refuge proposes to allow to persist when consistent with rare plant community conservation and habitat management actions. Therefore the acres of open water will fluctuate naturally over time.

The refuge seeks to restore forest cover to riparian corridors thus improving habitat and providing long-term beneficial impacts to brook trout, the state-listed rare reddsides, and the federally endangered Indiana bat. Menzel et al. (2005) found that Indiana bats concentrate foraging activities in forested areas rather than in grasslands or open fields. Restoring riparian forest connectivity and corridor width, through activities such as tree planting, would provide benefits to Indiana bats by improving and increasing foraging opportunities. In addition to those benefits discussed above, planting seedlings in riparian areas would stabilize stream banks and prevent erosion and sedimentation into the refuge's streams and rivers. An additional benefit to native and rare plant communities is that the refuge strives whenever appropriate to use Canaan Valley seed sources for seedling propagation which maintains and preserves the genetic integrity of plant resources on the refuge and in the valley.

Adverse Impacts

The refuge will minimize any adverse impacts from riparian restoration activities by allowing natural succession of woody species where appropriate. In areas where natural succession is limited by seed sources or other factors, the refuge will follow best management practices for restoration efforts to minimize adverse effects to wetland soils and streambanks.

**Impacts of Alternative C
(Maximize Public Use)**

All Wetlands

Benefits

Benefits to refuge wetland resources are similar to alternative B although benefits would be lessened by increased public use and construction activities (see Air Quality section for a list of refuge construction projects). Increased access for white-tailed deer hunt compared to alternative B would lead to a decrease in deer herbivory and would provide long-term benefits to wetland plant communities. Additional impacts related to the white-tailed deer hunting can be found in the refuge's "Amended Environmental Assessment Hunt Program Proposal" (April 2007).

Similar to alternative B, additional benefits to wetlands would occur from the designation of a RNA. Overall benefits would lessen as only 593 acres, composed of 92% wetlands and 8% uplands, would be included in the RNA.

Adverse Impacts

Alternative C is anticipated to have greater adverse impacts than those discussed under alternative B because of the maximization of public use under this alternative.

The creation of a cross valley trail from Brown Mountain Overlook to A-Frame Road requires skirting around sensitive wetlands that contain rare and sensitive plant communities. The refuge would construct a boardwalk in areas where sensitive wetland soils and plants would be affected by foot traffic and a bridge over the Little Blackwater River where riverbanks would be susceptible to erosion. Adding this infrastructure is preferable because it will minimize adverse impacts to sensitive wetland soils.

Dispersed use within the off-trail use zone would cause adverse impacts to wetland plant communities and wildlife. Impacts would be minimized as wetlands consist of only 4% of the total off-trail use zone and users would be spread over a large area. However, it will be difficult for the refuge to locate, monitor, and perform remediation measures on impacted wetlands due to unpredictable visitor use and spatial extent of the off-trail use zone. The refuge would minimize adverse impacts by limiting use to a time of year when the same or similar effects would come from hunting. However, visitor impacts would differ from hunting impacts as visitors are more likely to seek out views of streams and rivers, increasing the probability of adverse impacts to associated freshwater wetlands. In an effort to offset these adverse impacts the refuge is limiting visitor use to 25 permits per month on Sundays during the hunting season. By issuing special use permits the refuge would be able gather information on the number of users, the days and duration of use, and approximate location of use. This information would enable the refuge to monitor known locations of off-trail use for damage and perform remediation measures as needed. For additional information on the impacts related to the off-trail use zone see "*Effects of Public Use and Access, Public Use and Access Impacts from Alternative B.*"

We would continue raccoon hunting according to state seasons and current refuge regulations under alternative B. Anticipated effects are the same as alternative A. Adverse impacts to wetlands related to increases in hunting opportunities are discussed in the refuge's "Amended Environmental Assessment Hunt Program Proposal" (April 2007).

Forested wetlands**Benefits**

We would continue to conserve the refuge's 347 acres of forested wetlands under alternative C. Beneficial impacts to forested wetlands are discussed in "Impacts to Freshwater Wetlands from Alternative B – Forested Wetlands."

Adverse Impacts

Under alternative C, there are no activities specific to forested wetlands that would adversely affect this habitat type. Adverse impacts to forested wetlands are discussed in "*Impacts to Freshwater Wetlands from Alternative B – Forested Wetlands.*"

Forested wetlands – Aspen woodlands**Benefits**

Similar to alternative B, we would manage 114 acres of aspen woodlands within the 347 acres of forested wetlands on the refuge. Beneficial impacts from alternative C are the same as those discussed in "*Impacts to Freshwater Wetlands from Alternative B – Forested wetlands – Aspen woodlands.*" Any additional beneficial impacts to forested wetlands and aspen woodlands specific to alternative C are discussed in "*Impacts to Freshwater Wetlands from Alternative C - All Wetlands.*"

Adverse Impacts

Under alternative C, there are no additional activities specific to forested wetlands and aspen woodlands that would adversely affect this habitat type. Any adverse impacts from alternative C are similar to those discussed in "Impacts to Freshwater Wetlands from Alternative B – Forested wetlands – Aspen woodlands." Any additional adverse impacts to shrub and herbaceous wetlands that are specific to alternative C are discussed in "*Impacts to Freshwater Wetlands from Alternative C - All Wetlands.*"

Shrub and Herbaceous wetlands**Benefits**

We would continue to conserve the refuge's 5,060 acres of shrub and herbaceous wetlands under alternative C. Beneficial impacts from alternative C are similar to those discussed in "Impacts to Freshwater Wetlands from Alternative B – Shrub and Herbaceous wetland." Any additional beneficial impacts to shrub and herbaceous wetlands that are specific to alternative C are discussed in "Impacts to Freshwater Wetlands from Alternative C - All Wetlands."

Adverse Impacts

Under alternative C, there are no activities specific to shrub and herbaceous wetlands that would adversely affect this habitat type. Any adverse impacts from alternative C are similar to those discussed in "*Impacts to Freshwater Wetlands from Alternative B – Shrub and Herbaceous wetland.*" Any additional adverse impacts to shrub and herbaceous wetlands that are specific to alternative C are discussed in "*Impacts to Freshwater Wetlands from Alternative C - All Wetlands.*"

Open water/aquatic habitats**Benefits**

Environmental consequences are the same as discussed in, "*Impacts to Freshwater Wetland Habitats from Alternative B – Open water/aquatic habitats.*" Any additional beneficial impacts to shrub and herbaceous wetlands that are specific to alternative C are discussed in "*Impacts to Freshwater Wetlands from Alternative C - All Wetlands.*"

Adverse Impacts

Environmental consequences are the same as discussed in, “*Impacts to Freshwater Wetland Habitats from Alternative B – Open water/aquatic habitats.*” Any additional adverse impacts to open water and aquatic habitats that are specific to alternative C are discussed in “*Impacts to Freshwater Wetlands from Alternative C - All Wetlands.*”

**Impacts of Alternative D
(Focus on Managing for
Historical Habitat)**

All Wetlands

Benefits

Beneficial impacts from alternative D are similar to those discussed in “*Impacts to Freshwater Wetlands from Alternative B – All Wetlands.*” Wetlands and associated wildlife species would additionally benefit from limited vehicle access (same as alternative A) and a decrease in trail miles as a result of trail closures or changes from proposed trail connections in alternative B. If white-tailed deer harvest objectives are not met, the refuge would work with the state to increase deer hunting seasons and implement antlerless hunts to meet harvest objectives. These measures taken under alternative D would provide the most benefits by increasing the refuge’s flexibility to control white-tailed deer populations to benefit wetland plant communities and associated wildlife.



USFWS

Fawn

In alternative D we propose to eliminate night hunting for raccoon. The refuge has been concerned about disturbance to non-target species, including other nocturnal animals, as a result of this type of hunting. Although research has shown disturbance to be minimal to target species and some non-target wildlife (deer), the increased risk of disturbance and potential cumulative effects of this activity occurring during other regular hunt seasons creates a potential conflict with the overall goals of ensuring the biological integrity of the refuge. This added disturbance during a time when the refuge is otherwise closed to all other public uses detracts from the overarching goals of this alternative to restore natural processes and reduce disturbances which do not materially contribute to achieving historical plant and wildlife conditions.

Adverse Impacts

Adverse impacts from alternative D are similar to those discussed in “*Impacts to Freshwater Wetlands from Alternative B – All Wetlands.*” However, adverse impacts would not be as extensive because alternative D decreases trail miles as a result of trail closures. Trail closures would beneficially impact associated wetlands by limiting disturbance and the spread of invasive species to sensitive wetland communities.

Forested wetlands

Benefits

We would continue to conserve the refuge’s 347 acres of forested wetlands under alternative D; however, the refuge would not actively manage this habitat type which is predicted to succeed to globally rare conifer forested wetland types. Additionally, we expect an increase in overall patch size and acreage of forested wetlands thereby expanding a rare community type.

Adverse Impacts

Adverse impacts to forested wetlands are discussed in “*Impacts to Freshwater Wetlands from Alternative D – All Wetlands.*”

Forested wetlands – Aspen woodlands

Benefits

We would continue to conserve the refuge’s 114 acres of forested wetlands - aspen woodlands under alternative D. Beneficial impacts to forested wetlands and aspen woodlands are discussed in “*Impacts to Freshwater Wetlands from Alternative D – Forested Wetlands.*”

Adverse Impacts

Under alternative D, there are no new management activities specific to forested wetlands and aspen woodlands that would adversely affect this habitat type. Adverse impacts to forested wetlands and aspen woodlands are discussed in “*Impacts to Freshwater Wetlands from Alternative D – All Wetlands.*”

Shrub and Herbaceous wetlands

Benefits

We would continue to conserve the refuge’s 5,060 acres of shrub and herbaceous wetlands under alternative D. Beneficial impacts from alternative D are the same as alternatives B and C and are discussed in “*Impacts to Freshwater Wetlands from Alternative B – Shrub and Herbaceous wetland.*” Any additional beneficial impacts to shrub and herbaceous wetlands that are specific to alternative D are discussed in “*Impacts to Freshwater Wetlands from Alternative D – All Wetlands.*”

Adverse Impacts

Under alternative D, there are no activities specific to shrub and herbaceous wetlands that would adversely affect this habitat type. Adverse impacts from alternative D are the same as alternatives B and C and are discussed in “*Impacts to Freshwater Wetlands from Alternative B – Shrub and Herbaceous wetland.*” Any additional adverse impacts to shrub and herbaceous wetlands that are specific to alternative D are discussed in “*Impacts to Freshwater Wetlands from Alternative D – All Wetlands.*”

Open water/aquatic habitats

Benefits

We would continue to conserve the refuge’s 85 acres of open water and 55 miles of streams under alternative D. Beneficial impacts from alternative D are the same as alternatives B and are discussed in “*Impacts to Freshwater Wetlands from Alternative B – Open water/aquatic habitats.*” Any additional beneficial impacts to open water and aquatic habitats that are specific to alternative D are discussed in “*Impacts to Freshwater Wetlands from Alternative D - All Wetlands.*”

Adverse Impacts

Under alternative D, there are no activities specific to open water and aquatic habitats that would adversely affect this habitat type. Adverse impacts from alternative D are the same as alternative B and are discussed in “*Impacts to Freshwater Wetlands from Alternative B – Open water/Aquatic habitats.*” Any additional adverse impacts to open water and aquatic habitats that are specific to alternative D are discussed in “*Impacts to Freshwater Wetlands from Alternative D – All Wetlands.*”

Effects on Fisheries Habitats and Resources

We compared the management actions in the alternatives based on their potential to benefit or adversely affect the refuge's native cold water fishery, including actions to help maintain and improve the water quality of the Blackwater River, the refuge wetlands, and the watershed. We evaluated the benefits of actions that would benefit the fishery by protecting or restoring riverine functions influenced by vegetation and hydrology, and to otherwise maintain or improve water quality which include:

- acquiring and protecting land that would provide watershed benefits.
- protecting or restoring emergent wetlands.
- restoring hydrology.
- improving water quality monitoring for early problem identification.
- improving cooperation with other landowners to influence water quality in the watershed.

We compared the impacts of these refuge management actions with the potential to cause adverse effects on the fishery by:

- altering refuge hydrology or degrading water quality.
- applying herbicides to manage invasive species.
- stocking of non-native brown trout.
- prescribed fire to manage grasslands.
- constructing refuge projects (see section on *Effects on Hydrology and Water Quality*).
- changing recreational use that might lead to contamination by petroleum products, soil sedimentation, or erosion.

Impacts That Would Not Vary by Alternative

Benefits

Regardless of which management alternative we select, the Blackwater River watershed fisheries will continue to benefit from Service protection of the part of the watershed that provides good cover, food, and breeding habitat.

Adverse Impacts

Under all the alternatives, prescribed burning to maintain grasslands and silvicultural practices used to restore and enhance upland forested ecosystems may cause short-term, minimal, localized increases in turbidity. Controlling invasive plants with herbicides would not affect fisheries. This is because the formulation of glyphosate herbicide we would use is not toxic to fish or invertebrates, and quickly adsorbs to suspended and bottom sediments.

Bait-trapping and fishing competitions would not be permitted. A law enforcement presence would be required to prevent the illegal taking of fish, littering, or trespassing.

**Impacts of Alternative A
(Current Management)****Benefits**

Protecting 166 acres of streams, rivers, and open water under alternative A would benefit refuge fisheries by ensuring those habitats remain available for the long term.

Adverse Impacts

The Blackwater River is stocked with non-native brown and rainbow trout by the WVDNR. There is evidence that the continuation of stocking brown trout adversely impacts native brook trout populations. A literature review on the effects of stocking brown trout found they are excellent competitors and will displace brook trout when introduced into brook trout waters (Lasenby and Kerr 2001). The presence or introduction of brown trout in a stream has caused brook trout to shift microhabitats, alter their vertical distribution, and in many incidences has preceded the disappearance of native brook trout populations (DeWald and Wilzbach 1992, Lasenby and Kerr 2001). Similar findings have been documented by the Eastern Brook Trout Joint Venture (EBTJV) (2005). In addition, brown trout are known vectors of disease and parasites which could further impact native brook trout populations in Canaan Valley (EBTJV 2005, Lasenby and Kerr 2001).

We will continue to provide fishing opportunities, where approved roads or trails cross a waterway, from an accessible fishing pier on Timberline Road, and along shorelines accessible by canoes, kayaks, and other hand launched boats. Refuge visitors who boat and fish may cause localized, minor, short-term impacts by disturbing the bottom substrate in shallow water. In addition, discarded items such as fishing line, lures, and plastic containers present a risk for waterfowl and other birds. Increasing boat access would increase the risk of spreading aquatic invasive plants in refuge waterways. Brochures and signage would notify those visitors of proper precautions, including retrieving broken line and lures, carrying out all trash, and methods to reduce the spread of aquatic invasive species.

**Impacts of Alternative B
(Focal Species Emphasis)****Benefits**

Measures to enhance fishing opportunities include but are not limited to: 1) developing a coldwater fisheries restoration plan, 2) working with an interagency fisheries group to maintain a quality fishery while restoring native fish populations, 3) promoting awareness of designated fishing locations and refuge-specific and state fishing regulations, 4) educating anglers on the proper use and disposal of aquatic bait, and 5) educating anglers on controlling the spread of aquatic invasive plant species.

Under alternative B, refuge fisheries would benefit in the short- and long-term from wetland and riparian area restoration activities as discussed in *Impacts to Freshwater Wetlands from Alternative B – Open water/Aquatic Habitat*.

Benefits to native fish, particularly brook trout, would increase under alternative B as the refuge would pursue the possibility of stocking only native fish in the Blackwater River. This would reduce competition for resources and improve the health of native brook trout populations.

Adverse Impacts

Increased access will help accommodate demand for recreational fishing and fishing pressure in the watershed that is likely to increase with increasing visitation and increasing population. That increased pressure may cause decreases in fish populations of cold water fish such as brook trout. The refuge will maintain adequate cover and diverse aquatic biota, as our habitat-management goals and objectives were designed to do and that maintenance should ensure the sustainability of the fishery in the long-term.

Additional short-term, localized, adverse impacts may be observed from refuge construction and restoration projects that might cause soil erosion and sedimentation into refuge waterways. The refuge will adhere to best management practices to minimize any potential adverse effects. Long-term adverse impacts from increased trail miles and trail use might pose another concern to refuge fisheries. Trails that have stream and river crossings would likely degrade over time with increased use and contribute to downstream sedimentation and turbidity, which has been found to be a stressor to brook trout (Sweka and Hartman 2001) and redbreast dace (Holm and Crossman 1986) populations that are sensitive to habitat degradation. The refuge would monitor stream and river crossings closely and remediate any damaged areas to minimize adverse impacts associated with trail use.



Marquette Crockett/USFWS

Volunteers and staff surveying dragonflies

As in alternative A, refuge visitors who boat and fish may cause localized, minor, short-term impacts by disturbing the bottom substrate in shallow water. In addition, discarded items such as fishing line and lures and plastic containers present a risk for waterfowl and other birds. Increasing boat access would increase the risk of spreading aquatic invasive plants in refuge waterways. Brochures and signage would notify those visitors of proper precautions, including retrieving broken line and lures, carrying out all trash, and methods to reduce the spread of aquatic invasive plant species.

Adverse impacts related to stocking non-native fish are the same as discussed in Impacts of Alternative A. In the event that the state makes a determination to stock native brook trout rather than non-native brown trout, adverse impacts

to native brook trout populations would lessen by reducing competition for resources.

Impacts of Alternative C (Maximize Public Use)

Benefits

Beneficial impacts to fisheries from alternative C are the same as those discussed for alternative B. Benefits would be lessened in the short-term from increased refuge construction activities and increased visitor use.

Benefits to native brook trout from potentially stocking native fish are the same as those discussed in *Impacts to Fisheries Habitats and Resources from Alternative B*.

Adverse Impacts

Adverse impacts from alternative C are similar to alternative B. However, indirect adverse impacts are likely to increase in the short-term from an increase in refuge construction activities and in the long-term from an increase in visitor and trail use that might lead to increased soil sedimentation and increased turbidity in refuge waterways. Increased visitor use would likely increase fishing pressure and adversely impact the refuge fisheries.

Adverse impacts related to stocking non-native fish are the same as discussed in Impacts that would not vary by alternative and *Impacts to Fisheries Habitats and Resources from Alternative B*.

**Impacts of Alternative D
(Focus on Managing for
Historical Habitat)**

Benefits

Beneficial impacts to fisheries from alternative D are the same as those discussed for alternative B, although increased benefits to native fish would occur by working with the WVDNR to ensuring only native fish species are stocked in the Blackwater River. In contrast to alternatives B and C, fisheries in alternative D would additionally benefit from limited vehicle access (same as alternative A) and a decrease in trail miles as a result of trail closures or changes from proposed trail connections in alternative B. We expect refuge visitation to increase by 10 percent, as in alternative A, a percentage difference that is likely to reflect a lower level of fishing pressure and habitat disturbance compared to alternatives B and C.

Benefits to native brook trout from potentially stocking native fish are the same as those discussed in *Impacts to Fisheries Habitats and Resources from Alternative B*.

Adverse Impacts

Adverse impacts would not be as extensive as alternative B and C as alternative D limits vehicle access (same as alternative A) and decreases trail miles as a result of trail closures or changes from proposed trail connections in alternatives B and C. This lower use would reduce adverse impacts from soil sedimentation and erosion, turbidity, and streambank damage associated with increased access.

Adverse impacts related to stocking non-native fish are the same as discussed in *Impacts that would not vary by alternative and Impacts to Fisheries Habitats and Resources from Alternative B*.

**Effects on Endangered
and Threatened
Species**

Among our highest priorities on the refuge are the preservation, enhancement, restoration, and management of federally threatened Cheat Mountain salamanders and their habitat, and researching and monitoring populations. Fundamental in achieving our goals at the refuge is working toward the recovery of Cheat Mountain salamanders by maintaining and enhancing their habitat where conditions are suitable with a long-term goal of expanding Cheat Mountain salamander populations on the refuge.

Also important are efforts to help in the recovery of the federally endangered Indiana bat, which has been documented on the refuge during summer and fall months. Initial recovery efforts will focus on further verification of the identification of the species and on delineating where and how the Indiana bat utilizes suitable refuge habitats during the year.

Although the West Virginia northern flying squirrel has been delisted, the refuge, along with other federal, state, and NGO partners is committed to protecting, managing and monitoring habitat for and populations of the northern flying squirrel. A Memorandum of Understanding (MOU) was established in 2007 describing a red spruce-northern hardwood forest protection, management, and restoration vision which would sustain and enhance the viability of northern flying squirrel populations. From this MOU the refuge has committed to continuing monitoring efforts for the squirrel for at least 5 years after delisting as well as working to improve existing red spruce forest and restore this habitat on refuge lands.

We evaluated the management actions we proposed in the alternatives for their potential to benefit the endangered and threatened species by protecting them or their potential habitat. The benefits we considered included:

- protecting and enhancing Cheat Mountain salamanders and their habitat components at currently inhabited sites on the refuge; and Indiana bats where they occur or are likely to occur.
- restoration projects that might enhance the suitability of refuge habitats for Cheat Mountain salamanders and Indiana bats.

The potential adverse effects of the Canaan Valley management alternatives that we evaluated included impacts from:

- vegetation management methods that may affect the potential for successful recovery efforts for Cheat Mountain salamanders and Indiana bats or their habitats;
- recreation facilities or construction projects that might affect species habitats; and
- public activities on the refuge that might damage habitat or disturb the species.

In addition to evaluating the effects of our proposed actions on Cheat Mountain salamanders and Indiana bats, we are working with our WVFO to conduct an intra-Service section 7 consultation on all actions in this draft CCP/EA.

Impacts That Would Not Vary By Alternative

Benefits

Cheat Mountain salamanders—The Cheat Mountain salamander is a threatened species and a priority for Service protection and management. They are only found in West Virginia and are limited to approximately 80 disjointed populations from only five counties in the state. The refuge's population represents one of the most northern for this species. Being a federally threatened species tied to highly restricted plant communities, they are also considered a priority for conservation by the state as detailed in the state Wildlife Action Plan (WVDNR 2006).

Only one tract at the south end of the refuge has been documented as occupied habitat for this species. The Cheat Mountain salamander has only been documented on Cabin Mountain on the southeastern portion of that tract. The species requires high elevation mixed spruce and hardwood forests. Habitat requirements include a cool moist forest floor with adequate coarse woody debris and typically with a spruce or mixed spruce-hardwood forest overstory. Cheat Mountain salamanders occur in patchy distributions above 3,800 feet on refuge land. The smallest population of the salamander occurs on Cabin Knob with a known occupied habitat of only 0.5 acres. The largest known site on the refuge occupies at least 20 acres closer to Bald Knob.

Surveys for this species prior to tract acquisition documented occupied habitat broadly and included the areas where Powderline and Three-Mile Trail cross. Continued surveys by refuge staff have shown occupied habitat on both the uphill and downhill sides of both Powderline and Three-Mile Trails (USFWS unpubl. data). Surveys have found salamanders adjacent to approximately 690 feet of

Powderline and 1,180 feet of Three-Mile Trail. Both trails are old logging roads used prior to refuge acquisition for timber harvest operations. As such they were compacted and vegetated with grass to prevent erosion and increase stability. Current vegetation on these trails includes a mixture of grasses and ferns. In the location where salamanders are found, trail width varies but does not exceed 10 feet. In the absence of any future management trail width will remain the same as a result of soil compaction and grasses that remain from timber harvesting activities which prevent tree encroachment and growth.

Trails are narrow enough that partial forest canopy cover occurs along the length of both trail sections. The growth of trees adjacent to the trail is closing the canopy, increasing shade and soil moisture and reducing temperatures.

In all alternatives, the refuge will continue to protect known populations of Cheat Mountain salamanders and continue to conduct surveys to locate undocumented populations. Cheat Mountain salamander monitoring and research, conducted by the refuge and partners, will continue to focus on better understanding their habitat limitations, ways to improve their habitat, and mitigation to further recovery efforts on the refuge and other sites where populations are known or are likely to occur. On the refuge, long-term benefits to Cheat Mountain salamander populations are expected from red spruce restoration projects designed to increase acreage and connectivity of suitable habitat where populations have been documented.

The refuge will continue to coordinate with WVFO, the WVDNR, and our conservation partners to ensure that we utilize the best available science in our management decisions.



USFWS

Indiana bat

Indiana Bats—The refuge will continue monitoring efforts to determine foraging locations and extent of use on the refuge and conduct mist-netting surveys to verify presence of Indiana bats under all alternatives. Indiana bat documentations on the refuge are based on bat call surveys conducted from 2003 to 2008, which can sometimes be confused with little brown bat calls. Although the calls have been verified by experts, the refuge will conduct mist-netting surveys to further verify Indiana bat presence and on the refuge. Based on the bat call surveys, the refuge appears to provide foraging and roosting habitat for Indiana bats during the summer but no hibernacula or maternity colonies are known to exist in Canaan Valley. Additional survey efforts will improve knowledge of Indiana bat presence and use on the refuge thus providing long-term benefits through habitat improvement focused on meeting habitat requirements of Indiana bats. The refuge would provide long-term benefits to Indiana bats by continuing restoration of forested wetland and riparian habitat.

The refuge will continue to coordinate with the Indiana Bat Recovery Team, West Virginia Division of Natural Resources, U. S. Forest Service, and our conservation partners to ensure that we employ the best available science in our management decisions.

Adverse Impacts

Regardless of the alternative, we will continue to employ a range of management tools to achieve our objectives in managing for the recovery of federally listed species. We will use these tools only when and where necessary, and only with the proper training and focused application to avoid adverse impacts.

Cheat Mountain salamanders—We will carefully plan all refuge management actions that we might employ in or nearby habitats to ensure that we do not inadvertently alter cover characteristics. We will continue to employ outreach to adjacent landowners to ensure that they know about our recovery and restoration efforts, and to encourage them to help us protect Cheat Mountain salamanders and their habitat.

While foot traffic from cross-country skiers and hunters is not likely to adversely affect Cheat Mountain salamanders, since the salamanders generally emerge at the end of March and retreat underground in mid October, the continued maintenance of ski trails would perpetuate a narrow trail corridor through occupied habitat. However, the corridor itself is not considered suitable living habitat for the salamander and it is anticipated that the presence of the corridor does not completely limit movements across this trail.

Indiana Bats—Although no known maternity colonies have been documented on the refuge, West Virginia is within the Indiana bat's eastern maternity range (USFWS Draft Recovery Plan 2007) and a confirmed maternity colony was located on private land in Tucker County (Monongahela National Forest Final Environmental Impact Statement, 2008). It is likely that roosting colonies occur in Canaan Valley, which additional research will seek to confirm. If maternity and roosting colonies do exist or are likely to become established on the refuge, disturbance from visitor use could adversely affect Indiana bats. Any documented maternity or roosting colonies established on refuge lands will be protected from disturbance through temporary or permanent trail closures or creating restricted closed areas. Any actions to protect Indiana bat colonies will be coordinated with the WVFO.

**Impacts of Alternative A
(Current Management)**

Benefits

Cheat Mountain salamanders—Benefits to Cheat Mountain salamander populations are the same as those discussed in Impacts that would not vary by alternative.

Indiana Bats—Benefits to Indiana bats are the same as those discussed in *Impacts that would not vary by alternative*.

Adverse Impacts

Cheat Mountain salamanders—Under alternative A the refuge will continue to permit cross-country ski operations under current management conditions. For areas maintained by White Grass, this includes issuance of an annual Special Use Permit (SUP) with maintenance restrictions to improve habitat conditions and reduce wildlife disturbance. These conditions are also considered stipulations to ensure the activity remains compatible with the purposes of the refuge and the mission of the refuge system. Conditions required under the SUP include a four foot wide trail maintenance corridor, outside of which it is prohibited to cut vegetation or remove rocks or other woody debris. Maintenance operations are limited to occur between October 10 and April 30 to avoid times when salamanders are likely to be active. Skiing and grooming activities only occur during winter months when there is snow cover.

Public use on Powderline and Three-Mile Trail only occurs during winter months by cross-country skiing and snowshoe access when there is snow on the ground. During these times of year, salamanders are not active and are underground (USFWS 2009). Furthermore, because these trails are not open to the public outside of the winter time, the trails and the substrate on the trails remain undisturbed during the time of year when the salamanders are active. Therefore these public uses are not likely to adversely affect Cheat Mountain salamanders.

These old roads, now public use ski trails, have an altered micro-habitat and are not habitat for Cheat Mountain salamanders; therefore, we do not expect this species to be living in these trails. Therefore, the potential for Cheat Mountain salamanders to be present on the trails is limited to salamanders occasionally crossing the trail.

Salamanders may cross the trail in low numbers until temperatures drop and the salamanders are no longer active and present on the surface. Their presence on the surface is temperature- and moisture-dependent, thus dates of emergence and submergence depend on these environmental factors and can vary from year to year (Pauley 1978a; 1978b; Pauley 2005 in Pauley 2008c). It is estimated that when temperatures are below 550F salamanders are not likely to be active on the surface (USFWS 1991). Based on climate information from 1948 to 2000, average temperatures in Canaan Valley do not exceed 550F until May 14 and fall below 550F after September 26 (Brooks pers. comm.). Under the current conditions of the SUP, maintenance operations can only occur between October 10 and April 30. This is well beyond when salamanders are likely to be present on the surface. Therefore the chance of direct take is extremely unlikely (discountable).

The chance of direct take from maintenance activities is further limited due to the expected low amount of active maintenance conducted on these trail sections. Maintenance typically occurs on one to two days a year on these higher elevations trails and consists of hand crews with one ATV and trailer to haul equipment. ATV use is limited to usually two passes up and down the trail to move tools (Chase, pers.comm). Maintenance activities typically include the removal of downed trees and limbs which have fallen across the trail during the previous season and maintaining existing waterbars to prevent erosion. Maintenance activities occur within a 4-foot-wide corridor of the trail – two feet in either direction of the center line – as stipulated in the special use permit.. Any other activities related to trail maintenance occur within the footprint of the trail. The risk of the maintenance crew encountering a salamander is extremely unlikely to occur (discountable).

Trails have been noted impediments to Cheat Mountain salamander movements, possibly fragmenting and genetically isolating populations as well as making these populations more vulnerable to stochastic events. Pauley (unpubl. data in Service 1991) found that roads, and potentially some trails, serve as barriers that prevent territories of different individuals from overlapping, thus fragmenting populations and gene pools. Heavily traveled trails can result in removal of leaves and other forest litter, leaving bare trail treads (Service 1991; WVDNR 2000, 1999). Preliminary data suggest that Cheat Mountain salamander rarely cross trails and other openings that lack sufficient leaf litter cover (Pauley 2005 in Pauley and Waldron 2008). Cheat Mountain salamander use forest floor litter as foraging cover and refugia, especially during the day. Therefore, the extent to which trails and roads serve as a barrier to Cheat Mountain salamander most likely depends on the site-specific characteristics such as width, canopy cover, substrate material, compaction, and level/type of use.

Conditions related to blocking movements for salamanders appear to be related to increased temperature and humidity resulting from an open tree canopy as well as the removal of vegetation and leaf litter through public use activities creating bare soil conditions. The cross country ski trails that White Grass maintains are not used outside the ski season for public use and are not heavily traveled. Therefore excessive trampling resulting in the removal of litter and vegetation to create bare dirt surfaces does not occur on these trails. Because habitat on the trail is predominately grass and fern cover with limited rock and woody debris, it likely permits salamanders to move across the trail. In addition,

both Powderline and Three-Mile trails are narrow and have partial canopy cover providing shading and cooling effects to the trail surface. This creates more suitable conditions for salamanders to move across the trail. The lack of bare soil conditions coupled with the presence of canopy cover suggest that these trails do not create a barrier to salamander movement.

We do not expect the presence of these trails to fragment these populations and create genetic barriers. For this reason the trails are not likely to cause indirect adverse effects to Cheat Mountain salamanders.

Indiana Bats—Adverse impacts to Indiana bats are the same as discussed in *Impacts that would not vary by alternative*.

Impacts of Alternative B (Focal Species Emphasis)

Benefits

Endangered and threatened species would benefit under alternative B. In addition to specific actions to protect and enhance habitats and promote recovery, we plan to encourage protection of endangered and threatened species through increased educational awareness and cooperation with partners to achieve recovery goals.

Cheat Mountain salamanders—Under alternative B, additional benefits to Cheat Mountain salamander populations would be expected from reforestation of logging roads and revegetating the edges of Powderline and Three-Mile cross-country ski trails. Reforesting logging roads will improve habitat characteristics for Cheat Mountain salamanders by connecting fragmented forest blocks, increasing canopy cover, reducing sunlight on the forest floor, and increasing soil moisture. Revegetating segments of Powderline and Three-Mile trails by planting native tree species such as red spruce along the trails would eventually provide a more closed canopy over the trail and improve substrate and vegetation on the trail itself. Native tree species would eventually shade out all of the grass and fern cover which currently dominates the trails, and would improve microhabitat conditions for salamanders by increasing leaf litter, woody debris, and soil moisture (USFWS 1991). These trail improvements would provide a more conducive corridor for Cheat Mountain salamanders to move between upslope and downslope populations during the time of year when salamanders are active. Revegetation of refuge cross-country ski trails and increasing canopy cover is an additional conservation measure the refuge can accomplish to further enhance habitat conditions for the salamander.

These strategies would provide long-term benefits to Cheat Mountain salamanders that would not otherwise be realized within the time frame of this CCP.

Intra-Service consultation with the Service WVFO was conducted in 1999 and again in 2003 in regards to public use of the Kelly-Elkins Tract for cross-country ski operations. These are the only trails open for public use on the Kelly-Elkins Tract and the only trails which traverse known threatened species habitat. Both consultations concluded that the use was not likely to adversely affect the Cheat Mountain salamander or other species of concern as long as no new trails were developed and trail maintenance (tree removal and limb trimming) is limited. The refuge has consulted with the WVFO on the preferred alternative in the draft CCP/EA. The Field Office found that the proposed actions in alternative B are not likely to adversely affect threatened or endangered species (Appendix I).

Indiana Bats—Indiana bats would benefit from riparian restoration, early successional habitat management, and forested wetland restoration activities under alternative B. Romme et al. (1995) states Indiana bats are known to forage along forest edges, in early successional areas, and along strips of trees extending into more open habitat with available drinking water. Improving the refuge's habitats through restoration would provide long-term benefits to Indiana bats by increasing and improving suitable foraging habitat. Indiana bats would also benefit from increased monitoring efforts.

Also under alternative B, the refuge would survey for bats using acoustic monitoring equipment along with mist net surveys. The refuge would also determine summer roosting and foraging locations in Canaan Valley using radio telemetry of bats captured in mist nets. These increased monitoring efforts would help the refuge learn more about the movement patterns of Indiana bats in Canaan Valley and on the refuge.

Adverse Impacts

Our management activities under alternative B are not likely to adversely affect Cheat Mountain salamanders or Indiana bats. The construction projects we plan would have small-scale, localized effects that either would not affect these species at all or would cause negligible effects on their habitats.

Cheat Mountain salamanders—Adverse impacts are the same as alternative A. There will be no adverse impacts from the proposal in this alternative to revegetate portions of Powderline and Three-Mile trails. As with all trail maintenance activities, tree planting would only occur during the time of year when temperatures are below 550F (between October 10 and April 30) because this is when salamanders are not likely to be active on the surface (USFWS 1991). The chance of direct take from tree planting is further limited due to the expected low level of active maintenance that would be needed to plant trees, the small area that would be affected, and the short time period needed for planting. Planting would occur on perhaps two or three days in the spring and the fall and would be limited in duration to one or two years as there is only about 1,870 feet of trail to plant. As with the previously mentioned trail maintenance, planting would be conducted by hand crews with one ATV and a trailer to haul equipment. ATV use is limited to usually two passes up and down the trail to move tools (Chase, pers.comm). All tree planting activities would occur within the current footprint of the trail.



USFWS

Cheat mountain salamander

Furthermore, the ski trails have an altered micro-habitat and are not habitat for Cheat Mountain salamanders; therefore, even if animals were active at the time of tree planting, we do not expect this species to be living on these trails. The potential for Cheat Mountain salamanders to be present on the trails is limited to salamanders occasionally crossing the trail. Therefore, the risk of encountering a salamander on the trail while planting trees is extremely unlikely to occur (discountable) due to the time of year that tree planting would occur and the area within which the trees would be planted.

In the future, the refuge would also consider other options such as replacing trail segments with boardwalks to further facilitate salamander movement across trails. This action is one of the recommended management guidelines in the recovery plan for this species (USFWS 1991). In 2009, the Monongahela National Forest initiated a study to design more effective road and trail maintenance activities to benefit Cheat Mountain salamander populations (Pauley and Waldron 2008). If those results apply to habitats on the Canaan Valley NWR, the refuge will consider implementation of similar measures. Before undertaking such actions we would consult with the WVFO and complete additional NEPA analysis as necessary.

Indiana Bats—Adverse impacts to Indiana bats would be avoided under alternative B through management and restoration activities given current knowledge of Indiana bat use on the refuge. While the refuge would conduct hardwood forest cuttings to create early successional shrub habitat, cutting would not take place around streams, minimizing any impacts to Indiana bats. Indiana bat surveys would be conducted prior to cutting forest edge communities. Surveys will be coordinated with the WVFO.

**Impacts of Alternative C
(Maximize Public Use)**

Benefits

Cheat Mountain salamanders—Benefits to Cheat Mountain salamanders are the same as discussed for alternative B.

Indiana Bats—Benefits to Indiana bats are similar to alternative B., although monitoring efforts in the 2,330 acre off-trail use zone will be necessary to determine presence of Indiana bats. If Indiana bats are found in this area, benefits would lessen from year round visitor disturbance. The refuge seeks to minimize adverse impacts in the dispersed use zone by issuing no more than 25 permits per month and limiting use to Sundays during the hunting season.

Adverse Impacts

Cheat Mountain salamanders—Adverse impacts to Cheat Mountain salamanders are the same as discussed for alternative B. While visitor use is expected to increase under alternative C in comparison to the other alternatives, trail use in areas where there are known Cheat Mountain salamander populations only occurs during the cross-country ski season when salamanders are inactive and underground. There are no adverse effects anticipated from visitor use within the dispersed use zone because habitat within this zone is not suitable for Cheat Mountain salamanders.

Indiana Bats—Adverse impacts to Indiana bats, if any, are similar to those discussed in alternative B; however, adverse impacts would be far greater if maternity or roosting colonies of Indiana bats are found in the 2,330 acre off-trail use zone. Adverse impacts would be minimized by limiting off trail use to the hunting season, a period of time when Indiana bats would have already begun migration to their hibernacula outside of Canaan Valley (USFWS Recovery Plan 2007).

**Impacts of Alternative D
(Focus on Managing for
Historic Habitat)**

Benefits

Cheat Mountain salamanders—Alternative D would create the greatest long-term benefits to Cheat Mountain salamanders when compared with the other alternatives. By completely revegetating Powderline and Three-Mile cross country ski trails, the refuge would be able to restore forest habitat ultimately providing long-term benefits by recreating microhabitat conditions necessary for salamander occupation (breeding and feeding).

Indiana Bats—Benefits to Indiana bats would increase when compared to alternative C because alternative D would not open an area of the refuge for off-trail use. Therefore, the benefits would be similar to alternative B.

Adverse Impacts

Cheat Mountain salamanders—There will be no adverse impacts to Cheat Mountain salamanders under alternative D.

Indiana Bats—Adverse impacts to Indiana bats, would be avoided under alternative D, similar to alternative B, through management and restoration activities given current knowledge of Indiana bat use on the refuge.

Effects of Public Use and Access

Since refuge lands are held in the public trust by the Service, access is generally allowed for compatible, priority wildlife-dependent public uses. Uses are limited when federal trust resources will be impacted; the activity will detract from achieving refuge purposes or the refuge System mission, or when administrative resources are not available to ensure a safe, quality experience. Canaan Valley refuge is currently open to the following priority wildlife-dependent public uses: hunting, wildlife observation, photography, environmental education and interpretation. Under alternatives B, C, and D, we would officially open the refuge to fishing, which according to Service policy, is another priority, wildlife-dependent public use. Other uses which facilitate the priority public uses mentioned above include: horseback riding, bicycling, cross-country skiing, snowshoeing, and non-motorized boating. In the text below we describe in general the beneficial and adverse impacts of these uses. For more specific information on the potential beneficial and adverse impacts of these uses, especially in relation to alternative B, refer to the attached compatibility determinations (Appendix B).

Some regionally popular activities such as overnight camping and competitive races are not allowed on the refuge, as described in chapter 1.

We evaluated the benefits of the following management actions with the potential to affect the level of opportunity or visitor experience for those major activities listed:

- Service fee simple land acquisition will provide permanent access for approved activities.
- Improvement and/or new construction of visitor infrastructure, and the increased distribution of refuge information, will improve visitor experiences.
- Increased partnerships with local, regional, and state recreational interests will encourage a diversity of sustainable opportunities.
- Increased outreach and Service visibility will promote resource stewardship and outdoor ethics.

We evaluated and compared the following impacts that refuge management actions could have, or result in, on the level of opportunity and visitor experiences:

- Refuge acquisition may result in the elimination of non-wildlife dependent, non-priority activities that are presently allowed by the current owner.
- Refuge activities may attract an unanticipated increase in visitation, resulting in increased conflicts or negative encounters among users.
- Confusion could result over ownership boundaries and which laws, rules, and regulations apply between the refuge and other public lands.

Impacts That Would Not Vary by Alternative

Benefits

Regardless of alternative, we would continue to allow compatible, wildlife oriented public uses including hunting, fishing, observing, and photographing wildlife through hiking, biking, vehicle driving and horseback riding. We would also continue to allow cross-country skiing and snowshoeing to facilitate wildlife observation and photography in the winter, when access on foot is difficult. We would continue to provide the public with wildlife interpretation and environmental education opportunities. To support public use, we would continue to maintain the refuge facilities including the refuge headquarters, visitor's center, parking lots, observation platforms, hunt blinds, kiosks, and trails.

Adverse Impacts

Increasing visitation, and increasing the opportunities for compatible, wildlife-oriented, consumptive and non-consumptive uses would combine to increase the risk of conflicts between humans and wildlife and habitat damage. In all alternatives except alternative D, user conflicts might be offset by increasing the number of trail miles thereby spreading out users and decreasing their numbers in any one location. The likelihood of minor accidents would increase, particularly accidents involving bicyclists, pedestrians, and horseback riders, requiring increased law enforcement assistance on refuge trails. Parking issues will arise during times of heavy use, when lots fill and people try to park in unauthorized locations.

The following discussion focuses on impacts to vegetation and wildlife from visitor use activities. Impacts to hydrology and water quality, soils, uplands, and wetlands are discussed at a minimum in this section but are discussed in more detail in their related sections.

Impacts to Vegetation—Vegetative communities would experience direct, adverse impacts from pedestrians, bicycles, and horses crushing the plants where they exist on designated trails. Short-term effects consist of the deterioration of plant material, whereas long-term effects of trampling include direct and indirect effects on vegetation and soils like diminishing soil porosity, aeration, and nutrient availability through soil compaction (Roovers et al. 2004, Kuss 1986). Compaction of soils thus limits the ability of plants, particularly rare and sensitive species, to revegetate affected areas (Hammit and Cole 1998). Kuss (1986) found plant species adapted to wet or moist habitats are the most sensitive and increased moisture content reduces the ability of the soil to support recreational traffic.

Horse use may cause localized impacts to plants and soils when horses are confined. According to Cole (1983), bark damage from tethering horses to trees can result in insect invasions and girdling that can ultimately kill the tree. Direct adverse impacts might be observed on native plants from horses browsing while tethered. Exposed soil and an abundance of sunlight along roads and trails provide ideal conditions for the establishment of invasive plant species. Invasive plant species may be transported into the refuge through the presence of exotic plant seeds in feed hay. This concern has initiated strict requirements for weed free hay in some natural areas. At Yellowstone National Park, Green Mountain, and Fingerlakes National Forests in New York only processed feed (pelletized or cubed hay) or certified “weed seed free” hay is allowed in the back-country (Oloff 2002, Zimmer 2001). Currently, there are no programs to provide or certify weed free hay in West Virginia or in the surrounding vicinity (Rayburn 2001). According to the West Virginia Agricultural Extension office, two plants that could be easily transported in hay, via seed, are tall fescue (*Festuca arundinacea*) and reed canary grass (*Phalaris arundinacea*) (Rayburn 2001). The presence of reed canary grass has been documented on the refuge's wet meadows and fields.

Wells and Lauenroth (2007) found that horses have the potential to disperse a large number of seeds from a variety of plant types. Because horses take an average of 3 to 4 days, and up to 10 days, to eliminate the seeds they ingest, they represent an important vector for long distance seed dispersal from where the horses are kept to wildlands.

The refuge anticipates that there will be minimal adverse impacts to plant communities on designated routes. Designated trails for pedestrian and bicycle travel consist primarily of former logging roads, skid roads, and rail grades with hardened surfaces or are existing trails that have been used for many years. Most routes designated for horse use are highly modified vehicle access roads and old logging roads where common grass and sedge species were planted for erosion control or where plant communities are nonexistent on roadbeds consisting of hard-packed graded surfaces. As weed-seed free hay is not available in West Virginia, horses could introduce invasive plant species to the trails and adjacent habitats on the refuge. While no rare plant species or communities are known to exist on the trails, some rare plants have been documented adjacent to trails designated for pedestrian use. Users leaving designated trails could have impacts to adjacent vegetation. Where impacts to vegetation are observed, the refuge would take necessary measures, such as remediation and trail closures, to restore plant communities on or adjacent to the affected trail.

Impacts to Wildlife—Short-term and long-term adverse impacts would be expected for wildlife populations in relation to increasing trail miles and visitor use. Disturbances will vary by wildlife species involved and the type, level, frequency, duration and the time of year activities occur. Beale and Monaghan (2004) found that adverse effects to wildlife increase as number of users increase. The study found that an animal's response to one visitor walking down a trail is entirely different than its response to a group of users walking down a trail. The refuge recognizes that large group sizes may amplify negative effects to wildlife and requests that large groups notify the refuge prior to visiting to offset negative effects associated with large user groups, to understand which trails large groups prefer, and to monitor any potential adverse effects to wildlife and mitigate whenever necessary. Examples may include directing large groups to less sensitive habitats during breeding seasons or assigning refuge staff to lead or meet with the group while on refuge lands.

Disturbance can cause shifts in habitat use, abandonment of habitat, and increased energy demands on affected wildlife (Knight and Cole 1991). Miller et al. (1998) found bird abundance and nesting activities (including nest success) increased as distance from a recreational trail increased in both grassland and forested habitats. In this study, common species (e.g. American Robins) were found near trails and rare species (i.e. Blackburnian warblers) were found farther from trails. In some cases there is a clear link between the extent of disturbance and either the survival or reproductive success of individuals (e.g. Schulz and Stock 1993), but in many cases disturbance acts in a more subtle way, by reducing access to resources such as food supplies or nesting sites (Gill et al. 1996). Bird flight in response to disturbance can lower reproductive success by exposing individuals and nests to predators. For recreation activities that occur simultaneously (hiking, biking, and horseback riding) there would likely be compounding negative impacts to wildlife (Knight and Cole 1991).

There is evidence to suggest that species most likely to be adversely affected are those where available habitat is limited, constraining them to stay in disturbed areas and suffer the costs of reduced survival or reproductive success (Gill et al. 2001). Because of the diversity of habitats represented on the refuge, its rural setting, and adjacency to large tracts of protected lands, any population level

effects to wildlife species from trail use might be minimized by a theoretical abundance of habitat on the refuge and adjacent lands. However, the reverse is true when the argument is applied to hunting. For species like American woodcock where hunting is concentrated in high quality aspen stands, these habitat types could become ecological traps.

Wildlife disturbance may be compounded by seasonal needs. For example, causing mammals to flee during winter months would consume stored fat reserves that are necessary to get through the winter. Hammitt and Cole (1998) found white-tailed deer females with young are more likely to flee from disturbance than those without young. Some species, like warblers, would be negatively affected by disturbance associated with bird watching particularly during the breeding season.



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Cedar waxwing

For songbirds, Gutzwiller et al. (1994) found that low levels of human intrusion altered the singing behavior of some species. Disturbance may also affect the reproductive fitness of males by hampering territory defense, mate selection, and other reproductive functions of vocalizations (Arrese 1987). Disturbance, which leads to reduced singing activity, would make males rely more heavily on physical deterrents, which are time- and energy-consuming in defending territories (Ewald and Carpenter 1978).

Resources and Environmental Control completed a document on the “*The Effects of Recreation on Birds: A Literature Review*” in April 1999 (Bennett and Zuelke 1999). We refer to the following information from that document:

“Several studies have examined the effects of recreationists on birds using shallow-water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981; Burger 1986; Klein 1993; Burger et al. 1995; Klein et al. 1995; Rodgers & Smith 1995, 1997; Burger & Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbance from recreation activities always has at least temporary effects on the behavior and movement of birds within a habitat or localized area (Burger 1981, 1986; Klein 1993; Burger et al. 1995; Klein et al. 1995; Rodgers & Smith 1997; Burger & Gochfeld 1998). The findings these studies report appear in summary below in terms of visitor activity and avian response to disturbance.

- Presence: Birds avoided places where people were present and when visitor activity was high (Burger 1981; Klein et al. 1995; Burger & Gochfeld 1998).
- Distance: Disturbance increased with decreased distance between visitors (Burger 1986), though exact measurements were not reported.
- Approach Angle: Visitors directly approaching birds on foot caused more disturbance than did visitors driving by in vehicles, stopping vehicles near birds, or stopping vehicles and getting out without approaching birds (Klein 1993).

- Direct approaches may also cause greater disturbance than tangential approaches to birds (Burger & Gochfeld 1981; Burger et al. 1995; Knight & Cole 1995; Rodgers & Smith 1995, 1997).
- Type and Speed of Activity: Joggers and landscapers caused birds to flush more than anglers, clammers, sunbathers, and some pedestrians, possibly because the former groups move quickly (joggers) or create more noise (landscapers). The latter groups tend to move more slowly or stay in one place for longer periods, and thus birds likely perceive these activities as less threatening (Burger 1981, 1986; Burger et al. 1995; Knight and Cole 1995a). Alternatively, birds may tolerate passing by with unabated speed whereas if the activity stops or slacks birds may flush (Burger et al. 1995).
- Noise: Noise caused by visitors resulted in increased levels of disturbance (Burger 1986; Klein 1993; Burger & Gochfeld 1998), though noise was not correlated with visitor group size (Burger & Gochfeld 1998)."

Additionally, dogs frequently accompany recreationists to protected areas and their presence can lead to short-term and long-term adverse impacts to wildlife populations. Some wildlife species are particularly sensitive to the presence of dogs and their response to disturbance is amplified above and beyond disturbance effects from recreationists traveling without dogs. Declines in bird diversity and abundance on trails where leashed dogs were permitted were in excess of declines observed from human disturbance alone (Banks and Bryant 2007). Lenth and Knight (2006) found, in areas that prohibited dogs, mule deer were less active up to 50 meters from recreational trails. In areas that allowed dogs, mule deer showed reduced activity within at least 100 meters of trails. The same study found similar adverse effects for small mammals including squirrels, rabbits, chipmunks, and mice. This means that there is a certain area around recreational trails that becomes unsuitable habitat for certain wildlife species, even though the habitat would otherwise be suitable (Lenth and Knight 2006). In addition, native carnivores, bobcats and coyotes, also appear to shift their periods and areas of activity to avoid peak times of recreational use (George and Crooks 2006). In all alternatives, the refuge permits dogs on leashes. This restricts dog activity to a narrower trail corridor and minimizes adverse effects to canine sensitive wildlife species. Additionally dogs will not be permitted off-trail except for hunting.

We will take all necessary measures to mitigate those effects, particularly where group educational activities are involved. We will evaluate the sites and programs periodically to assess whether they are meeting the objectives, and to prevent site degradation. The refuge trail monitoring plan addresses the potential physical impacts of the trail bed, including percent trail incision, exposed roots and puddles. The plan also addresses the number of "bootleg trails" and trail width. The refuge also established a list of criteria (see Compatibility Determinations for public uses) that will be used to evaluate when the level of use or the manner of the use becomes incompatible with the mandate to protect the physical resources (soils, vegetation) of the refuge. If the use causes evident and unacceptable adverse impacts, the refuge would rotate the activities to secondary sites, or curtail or discontinue them. Mitigation measures to prevent or limit the effects of public use are primarily tied to trail design and annual maintenance. Actions such as annual water bar clearing, removing downed brush and blocking areas of active bootleg trails can effectively reduce the overall physical impact of trail use on the refuge. We will post and enforce refuge regulations, and establish, post, and enforce closed areas.

Impacts of Alternative A (Current Management)

Benefits

The refuge will continue to provide 40.6 miles of roads and trails (see the text box below for a comparison of trail miles across all alternatives) to facilitate wildlife observation and photography interpretation and education on the refuge. Other than completing an Americans with Disabilities Act accessible boardwalk loop on the Freeland tract that gives visitors an opportunity to experience refuge wetlands and their plants and wildlife, no other improvements to infrastructure are planned. The refuge will continue to operate the visitor’s center to educate and inform visitors about the refuge’s resources and viewing opportunities.

Adverse Impacts

A 10 percent increase over current visitation, resulting in an expected 22,000 annual visitors over the next 15 years, is predicted based on regional tourism trends and planned visitor services activities. We do not anticipate that this increase would adversely affect resources or use and enjoyment by visitors because the increases projected for the refuge would be well-distributed. Adverse impacts would be the same as those described in *Impacts that would not vary by alternative*.

Adverse impacts from permitting leashed dogs to accompany visitors on refuge trails are the greatest under alternative A when compared to the other alternatives because there is no stipulation on leash length in alternative A. The zone of habitat disturbance would increase or decrease depending on leash length, creating variable and unpredictable disturbance for wildlife species in comparison to the other alternatives.

Table 4.11. Trail Miles and Designated Uses for each Alternative

Trail Use	Alternatives (in miles)			
	A	B	C	D
Pedestrian	30.2	34.4	37.3	28.7
Bicycle	21.7	25.5	26.8	20.2
Horseback	20.7	20.7	20.7	19.2
Vehicle	7.0	7.0	7.9	7.0
Cross-Country Ski and Snowshoe (trails open seasonally)	10.4	10.4	10.4	9.7
+Total Miles of Trail	40.6	44.8	48.6	38.4

Impacts of Alternative B (Focal Species)

Benefits

Under alternative B, a total of 44.8 miles of trails would be available for wildlife observation and photography, which is an increase of 4.2 miles of trail in comparison to alternative A. As in alternative A, off-trail use would be allowed by special use permit only. Additionally, a number of visitor infrastructure construction and improvement projects will provide and expand opportunities for the public to participate in wildlife-oriented activities.

Adverse Impacts

A 15 percent increase over current visitation, and an increase in opportunities for compatible, wildlife-oriented, consumptive and non-consumptive uses would combine to increase the risk of conflicts between humans and wildlife and habitat damage. Conflicts between users might be offset by increasing the number of trail miles thereby spreading out users and decreasing their numbers in any one location. The likelihood of minor accidents would be greater, particularly those

involving bicyclists, pedestrians, and horseback riders that will require law enforcement assistance on refuge trails. Parking issues will arise during times of heavy use, when lots fill and people try to park in unauthorized locations.

With increasing visitation, additional visitor infrastructure, and an increase in the total number and miles of trails available, adverse impacts related to visitor use would increase. In addition to expanding the trail system, the refuge will open the western portion of Brown Mountain Overlook to bicycle use. While pedestrian impacts to trails have been described in *Impacts that would not vary from all alternatives*, additional adverse impacts would occur from bicycle use on the trail. In an analysis conducted by Natural Resource Conservation Service in 2002, 35 % of the Brown Mountain Overlook trail was rated as “high” for compaction potential and severely limited for hiking trails. Trail erosion potential was generally low compared to soils associated with trails; however there are short segments that are a concern (Bell 2002). In order to minimize impacts, the refuge would improve those segments identified by Natural Resource Conservation Service and monitor and remediate as needed.

While evidence suggests that leashed dogs create a zone of disturbance for wildlife species, the refuge would restrict leash length to 8 feet in this alternative to minimize the zone of disturbance.

Impacts of Alternative C (Maximize Public Use)

Benefits

This alternative provides the most opportunities for wildlife observation and photography. Alternative C will provide about 48.6 miles of trails, which is an increase of about three miles of trails from alternative B. Under alternative C additional opportunities for wildlife observation and photography would be provided by constructing a cross valley trail from Brown Mountain Overlook trail to A-Frame Road. The creation of the cross valley trail will lead visitors around a beaver pond complex on the west, through a cottongrass bog on an existing rail grade, and up through a northern hardwood forest to connect with A-Frame Road on the east. As in alternative B, the trail from Camp 70 Road to Cortland Road would provide key connectivity to the trail system within the refuge from the north end to the south end of the valley. The refuge would also construct a parking lot and an ADA accessible observation platform on the Camp 70/Delta 13 trail if the West Virginia Department of Transportation abandons the road. Also in alternative C, the refuge would provide a 2,330 acre off-trail use zone that will be accessible to visitors on Sundays during the refuge’s hunting season for wildlife observation and photography. This area will give visitors the opportunity to experience and explore off trail refuge habitats like speckled alder and spirea stands, forested wetlands, spruce-fir and northern hardwood forests, rivers, streams, and ponds.

Adverse Impacts

In comparison to all other alternatives, alternative C has the greatest potential for short-term and long-term adverse impacts. In addition to the adverse impacts discussed for alternative B, additional and similar adverse impacts would be observed with the construction of the two new trails discussed above, the potential Camp 70 road improvement, parking lot, and observation platform, and maximizing off-trail use on the refuge. Because visitor use is projected to increase by 20 percent, the most of any alternative, there would be the risk of increased conflicts between humans and wildlife and increased habitat damage.



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Staff day hike

Under alternative C, if West Virginia Department of Transportation abandons Camp 70 road, the refuge would improve the road either half-way to the end or all the way to the end, where the road overlooks a series of Beaver ponds. Where the road improvements end a parking lot and observation platform would be constructed. Adverse impacts related to soils, hydrology and water quality, and uplands would be minimal and are discussed in their respective sections. Although adverse impacts would be expected to increase where the entire road length is improved, all construction activities would take place on highly modified upland soils leading to no net loss of upland habitat. The improvement of Camp 70 road would increase vehicle access into the refuge which would increase disturbance to wildlife, like snipe and American bittern and waterfowl using adjacent beaver ponds. It could also have detrimental effects on amphibian populations through direct mortality of individuals crossing the road and indirect effects associated with water runoff.

Construction of a cross-valley trail connecting the Brown Mountain Loop trail and A-frame Road using an existing railroad grade, under this alternative would affect wetlands and their associated plant communities. A conceptual design and tentative location for a trail are identified in the Canaan Valley National Wildlife Refuge – Cross valley trail feasibility study (Vanasse Hangen Brustlin (VHB Inc.), Inc 2008)). This trail would be modified to skirt wetland areas to reduce impacts and constructed boardwalk distance. The trail would be approximately three miles long, designed to route visitors through thickly vegetated bog habitat interspersed with beaver ponds crossing over the Little Blackwater River before continuing due east, up steep grades on Cabin Mountain until reaching A-Frame Road. Creation of the trail would require considerable infrastructure.

In areas where the existing railroad grade needs improvement and where sensitive wetland plant communities would be adversely impacted, a boardwalk would be constructed. Due to steep topography access to the rail grade for construction purposes does not appear to be feasible from Camp 70 road and would require road improvement from A-Frame road. In addition, new trail construction would be necessary to route the trail around an existing beaver pond and connect to the Brown Mountain Overlook trail on the west and A-Frame Road on the east.

Construction of boardwalks over sensitive wetlands and a bridge over the Little Blackwater River would have short-term adverse affects to sensitive wetlands from the installation of pilings for boardwalk and bridge placement; however, further investigations on construction alternatives are necessary to determine adverse impacts. In order to make an assessment of impacts, the refuge needs to conduct investigations of subsurface conditions to determine foundation support options. Each option would require a different type of equipment and impacts associated with that equipment would vary depending on the types of equipment used. For example, a relatively thin layer of organic matter (e.g. 0-4 feet in depth) may only require a hand auger for pile placement, which would create localized and minimal adverse impacts. If organic matter depths are determined to be greater than five feet, heavier equipment would likely be needed and the feasibility of mobilizing this equipment to the site is questionable (Haley & Aldrich Inc., 2008). Due to the remote location and accessibility issues of this trail the refuge may have difficulty getting the appropriate construction equipment to the site without causing severe soil erosion, compaction and loss of plant communities.

There would be minimal long-term adverse effects to sensitive wetland vegetation from shading created by the boardwalks. When compared to the use of other trail infrastructure as analyzed by VHB Inc. (2008), elevated boardwalks were found

to offer the most protection to wetland plant communities by eliminating direct impacts associated with foot travel off of the existing railroad grade to avoid seasonally wet or inundated sections of the trail. VHB Inc. (2008) estimates that only 0.2 acres of wetland vegetation would be adversely impacted from boardwalk shading.

Through the construction process as well as once the route is established, sensitive wetland plant communities and rare species could be adversely impacted through the introduction of invasive or exotic species. This would be particularly detrimental in an area where the plant communities have been labeled as 'pristine.' Allowing public use, in the form of foot travel, would likewise increase the probability of introducing invasive species into this area. Garlic mustard, as an example, is an invasive weed that easily establishes along roadsides and trail edges and has been found in multiple locations on A-frame road. It spreads quickly by sticking to animal fur, being carried by flowing water, and introduction associated with human activities. Garlic mustard seeds could easily be spread down the trail by trail construction and public use activities. Construction equipment could easily carry seeds and soil disturbance created by construction would provide an opportunity for species establishment in new locations along the road. In addition, Stout (1992) found that trails created through emergent wetlands in Canaan Valley were colonized by barnyard grass (*Echinochloa crusgalli*). This species is on the state list of invasive exotic plants and has the ability to displace native plants. Preventing the spread of invasive species is a refuge priority. As such, the refuge would seek to minimize adverse impacts by proactively monitoring for and aggressively treating any documented invasive or exotic species.

Increasing public access into an otherwise remote and undisturbed area of the refuge is also likely to increase wildlife disturbance. Most of the cross valley trail occurs in open habitat and along ecotones creating greater potential for flushing or disturbing wildlife utilizing these habitats.

In order to reduce impacts to soils and plant communities along the cross valley trail the refuge would have to mow vegetation on the trail in effort to clearly delineate the trail corridor and keep pedestrians from deviating from the trail. Trail maintenance in the middle of Canaan Valley will be difficult and the transportation of maintenance equipment into the valley could adversely affect wetland soils and soils on the steep gradient leading to/from A-Frame and Camp 70 Roads increasing the possibility for soil erosion and sedimentation.

Trail construction under this alternative would create adverse impacts to wetlands, uplands, soils, hydrology, and water quality. These impacts are discussed in their respective sections.

As in alternative B, we would restrict dog leashes to 8 feet in length, therefore minimizing the zone of disturbance from dogs.

**Examples of Rare Plants Known to Occur in the
Off-Trail Use Zone**

Balsam Fir	(<i>Abies balsamea</i>)
False Violet	(<i>Dalibarda repens</i>)
Silvery Sedge	(<i>Carex canescens</i>)
Black-girdled wool-grass	(<i>Scirpus atrocinctus</i>)
Pussy Willow	(<i>Salix discolor</i>)
Sweet-scented Indian Plantain	(<i>Hasteola suaveolens</i>)

In addition to the adverse impacts listed above and in *Public Use and Access Impacts that would not vary by alternative*, adverse impacts to vegetation, wildlife, rivers, streams, and open water from off trail use would likely be greater in alternative C. In contrast with trails where disturbance is concentrated around the trail corridor, disturbance from off-trail use would be widespread within the off-trail use zone and similar to impacts associated with hunting activities. Numerous studies have



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Mountain ash

found for wildlife that the area of disturbance is greatest for off-trail recreational activities (Miller et al. 2001) and that wildlife response was greatest when human activity was spatially unpredictable as it would be in the off-trail use zone (Schultz and Bailey 1978, MacArthur et al. 1982, Hamr 1988, Kenny and Knight 1992, Knight and Cole 1995). Off trail use would also adversely impact plant communities as occasional trampling has been shown to cause severe disturbance and structural damage to plants (Roovers et al. 2004). This is especially problematic for rare and sensitive plant species and communities that are known to occur within the off-trail use zone. Sweet-scented Indian plantain (*Hasteola suaveolens*), a state species of special concern that is found only in riparian corridors, would be particularly susceptible to

off-trail activities concentrated along the Blackwater River. Adverse impacts to soils and hydrology

might also occur from off trail use. Because the use will be widespread over 2,330 acres it will be difficult for refuge staff to monitor disturbance and perform remediation measures when necessary.

The refuge does seek to minimize adverse effects by designating the location, the timing, and the duration of off-trail use activities. In the off-trail use zone, no more than 25 permits would be issued per month and the use would occur on Sundays during the hunting season under alternative C. This would limit the extent of off-trail wildlife disturbance to a time of year when the same responses would be elicited from hunting activities. In addition, the refuge seeks to minimize damage to plant communities, especially those that provide ground cover, by allowing off trail use outside of the growing season for most plants. Senescence for most plant species on the refuge takes place prior to October.

Impacts of Alternative D (Focus on Managing for Historical Habitat)

Benefits

In general, under alternative D, public use opportunities would be similar to alternative A. Alternative D would provide trails totaling 38.4 miles, which is a decrease in trail miles compared to the other alternatives. In addition, the refuge would not allow access to the off-trail use zone discussed in alternative C. A reduction in public use activities would allow greater protection of refuge resources.

Adverse Impacts

Under alternative D, adverse impacts would lessen in comparison to the other alternatives. Alternative D would reduce the number of trail miles available for public use and would not open an area of the refuge for off-trail use.

Adverse impacts from allowing dogs to accompany visitors are the same as alternative B.

Cumulative Impacts

According to the Council on Environmental Quality NEPA implementing regulations at 40 Code of Federal Regulations §1508.7, “Cumulative impact” is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

This cumulative impacts assessment includes other agencies' or organizations' actions if they are inter-related and influence the same environment. Thus, this analysis considers the interaction of activities at the refuge with other actions occurring over a larger spatial and temporal frame of reference.

Air Quality

None of the alternatives are expected to have cumulative adverse impacts on air quality locally or regionally in West Virginia. Some short-term, localized deterioration in air quality would be expected from air emissions of motor vehicles used by refuge visitors and staff. Visitors would access the refuge by automobile, with approximately 50 percent of the more than 25,000 annual visits expected to originate outside the Tucker County area. For most visitors the refuge would be one of several stops when they make this area their destination. Our trails and activities will complement those of other land managers in the area to enhance visitors' experience.

We predict no cumulative impacts to Class 1 airsheds from our actions; the closest Class 1 area being the United States Forest Service's Dolly Sods Wilderness Area which borders the refuge. The air quality and visibility problems that occur there are caused by ozone and particulate emissions from major sources to the west and north. Actions at the refuge would not contribute to that problem.

With our partners, we would continue to contribute to improving air quality through cooperative land conservation and management of natural vegetation and wetlands. Protecting land from development, and maintaining it in natural upland vegetation or wetlands, assures these areas would continue to filter out many air pollutants harmful to humans and the environment.

Soils

The greatest past, present, and foreseeable future adverse impacts on the soils in the Blackwater River watershed are largely from recreational activities (e.g. ATV races in Canaan Valley's sensitive wetlands) conducted prior to refuge acquisition. We will improve watershed soil conditions and minimize site-level soil impacts by restoring the vegetation of developed sites, roads, and trails; limiting recreational use to trails; employing best management practices on restoration and construction sites; collaborating in protecting land with important habitat; and exchanging technical information with landowners throughout the watershed.

We would accomplish that to some degree under alternative A. Under alternatives B, C, and D, we propose a wide range of restoration and mitigation practices to improve soil conditions on all refuge land in the watershed.

Hydrology and Water Quality

Restoring disturbed sites and unused roads and trails on refuge lands would produce cumulative benefits for water quality. More intensive measures to restore natural hydrology, such as removing culverts, recontouring railgrades, restoring wetlands, and restoring riparian areas would also produce cumulative benefits under alternatives B, C, and D.

None of the alternatives would produce major, adverse, cumulative effects on water quality. We would use best management practices and measures to control erosion and sediment on construction sites to ensure minimal impacts. Those projects are widely dispersed through the refuge, so their local effects would not be additive.

Biological Resources – Conserved Habitats and Focal Species

All alternatives would maintain or improve biological resources on the refuge, in the Blackwater River watershed, and within the Mid-Atlantic Ridge and Valley ecosystem. The combination of our management actions with other organizations' actions could result in major, beneficial cumulative effects by: (1) increasing conservation and management for federal and state-listed threatened and endangered species; (2) improving uplands and regionally declining wetland habitats; and (3) preventing spread or reducing invasive plants and animals.

The Service staff recognizes that all uses of refuge lands create some impact on refuge wildlife and their habitats. Those refuge uses, taken together, have the potential to create accumulating impacts as the number of uses increases. Because of that potential, refuge uses are limited to those which we have formally determined to be compatible with the purposes for which the refuge was established and the mission of the refuge system. The refuge acknowledges that increasing public use could cumulatively impact biological resources and contribute to habitat degradation in the off-trail use zone where consumptive and non-consumptive use areas overlap. These uses that take place within the same general timeframe create an overall greater zone of disturbance than either use taken individually. When we review those formal compatibility determinations (every 10 to 15 years), we will consider possible accumulating affects that may have occurred in succeeding years, and will address them as necessary. We do not expect alternatives A, B, C, or D to have major cumulative impacts.

There would be no significant cumulative adverse effects to biological resources under any of the alternatives because the changes in habitat components that we would manage for directly or expect to realize through natural succession would balance to be beneficial. Biological resources that we would manage to prevent their introduction, limit, or eliminate, such as invasive plants, are not natural components of the Canaan Valley refuge ecosystem. Losses of those biotic components where they occur would not be considered adverse.

Environmental Justice

Executive Order 12898 “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” (February 11, 1994), requires that federal agencies consider as part of their action, any disproportionately high and adverse human health or environmental effects to minority and low income populations. Agencies are required to ensure that these potential effects are identified and addressed.

Existing Socio-Economic Conditions

The EPA defines environmental justice as; “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.” In this context, fair treatment means that no group of people should bear a disproportionate share of negative environmental consequences resulting from the action.

Consideration of the potential consequences of the proposed action for environmental justice requires three main components:

- A demographic assessment of the affected communities to determine whether minority or low income populations are present;
- An integrated assessment of all potential impacts identified to determine if any results in a disproportionately high and adverse impact to these groups; and
- Involvement of the affected communities in the decision-making process and in the development and implementation of any mitigation strategies.

Minority populations are not likely to be affected at the refuge. The minority populations of both Tucker County and Randolph County were 1.2 percent and 2.3 percent, respectively (Census 2000). This constitutes a substantially smaller proportion of the total population than that for the state of West Virginia, 6 %, and for the Nation as a whole, 24.9%.

Socioeconomically disadvantaged populations are present and may be affected by actions taken at the refuge. The percent of individuals who are socioeconomically disadvantaged (living in poverty) in West Virginia is 17.9% (Table 2.3). Tucker County's poverty level exceeded both the state and national average at 18.1%.

Summary of Consequences to Environmental Justice

The communities surrounding the refuge are relatively homogenous; minority groups do not represent a substantial portion of the affected community. No differential impacts based on minority status would therefore be anticipated under any of the alternatives.

Tucker County, West Virginia is a socially disadvantaged community with a greater percentage of persons living below poverty than the state overall. Therefore, environmental justice considerations do apply to actions taken by the Service at the refuge with respect to potential adverse effects on the socioeconomically disadvantaged communities.

Economically, these communities would benefit under all management alternative in terms of realizing increased revenues to offset property taxes on acquired lands and in terms of additional jobs and increased personal income. It is not likely that any of these communities would be adversely affected by loss of access to game or fish for those who use them to supplement their annual diet, because hunting and fishing will remain a part of compatible activities on the refuge.



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Field sparrow nest

Table 4.12: Summary Impacts Comparison of the Alternatives

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
Air Quality			
<i>Impacts that would not vary by Alternative</i>			
<p>No adverse affects to regional air quality, regardless of management alternative. None of the alternatives would violate EPA standards; all four would be in compliance with the Clean Air Act. None of the proposed management alternatives would affect visibility. Although we would conduct prescribed burns to manage grassland and invasive species, we would monitor and control the burning carefully to keep the risk of wildfire low. When using herbicides we will take all precautions with respect to wind conditions, time of day, and proper equipment to ensure that we expose only target plants to the chemical. We will make responsible energy use fundamental in the development and operation of our lands and facilities, as well as in contractor and commercial visitor services.</p>			
<p>Proposed refuge management activities would neither substantively benefit nor adversely affect currently good local and regional air quality, with no violations of federal or state Clean Air Act standards, no impacts to nearby Class I areas, and no cumulative effects on regional ozone or particulate matter pollutant levels.</p> <p>Minor air quality benefits from the air pollutant filtering effects of 16,183 acres of upland, riparian and wetlands vegetation and from adopting energy efficient practices. There would be a negligible reduction in atmospheric carbon due to the sequestering effects of 6,962 forested acres.</p> <p>Limited ground disturbing activities and limited introduction of new emissions sources will minimize impacts.</p> <p>10 percent increase in annual refuge visits by motor vehicle would cause a minor increase in air emissions in the long term and contribute minimally to potential cumulative effects.</p>	<p>Effects similar to alternative A. No substantive change in air quality; no violation of standards, no impacts to Class I areas, and no cumulative effects. Locally more minor long-term benefits than alternative A but also more potential short-term adverse effects.</p> <p>Benefits would increase from maintaining additional forested acres within acquisition boundary.</p> <p>Forest restoration and stand enlargement would increase carbon sequestration benefits.</p> <p>Trail, infrastructure, and parking lot construction would cause minor short-term, localized impacts from vehicle and equipment emissions and dust during construction.</p> <p>A 15 percent increase in annual visitation would result in more motor vehicles and therefore higher local air pollutant emission levels than in alternative A over the longer term, and would increase the potential for cumulative effects.</p>	<p>Alternative C would have benefits similar to alternative B, although increased short-term, localized impacts are expected from increases in visitor use and additional trail and infrastructure construction activities.</p>	<p>Alternative D would have the greatest long-term benefits to air quality through the long-term predominance of mature forest stands and increased forest restoration minimally increasing carbon sequestration.</p> <p>Impacts from infrastructure and parking lot construction are similar to alternative B.</p>

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
Hydrology and Water Quality			
<i>Impacts that would not vary by Alternative</i>			
<p>Acquisition and conservation of more than 8,932 additional acres of wildlife habitat within the acquisition boundary would further benefit water resources because acquisition would increase watershed protection, which would ensure the integrity of wetland habitats. Stringent precautions in conducting refuge management activities such as herbicide application would prevent chemical contamination of water directly through leaks or spills or indirectly through soil runoff.</p> <p>Alternative A would provide minor watershed benefits and cause minimal adverse effects to refuge hydrology and water quality. Acquiring 8,949 additional acres of upland forest, wetlands and other lands within the acquisition boundary would increase protection of the watershed.</p> <p>Stringent precautions in conducting refuge management activities would prevent chemical contamination of water directly through leaks or spills or indirectly through soil runoff.</p> <p>An increase in visitor use activities might cause river and stream soil sedimentation and petroleum product contamination. Public outreach on that and other issues such as invasive aquatic weeds, invasive fish, and lead contamination would help mitigate that risk.</p>	<p>Local hydrology would improve through road reconstruction, road removal, culvert removal, and hydrologic restoration of wetland complexes.</p> <p>Designation of a 754-acre Research Natural Area (RNA) would benefit wetlands and associated rivers and streams by preserving wetland plant communities and rare plant species.</p> <p>Trail, infrastructure, and parking lot construction would cause minor short-term, local effects from soil runoff and sedimentation.</p> <p>A refuge-run shuttle service would minimally impact Glade and/or Sand Run during the first 3 days of deer-gun season.</p>	<p>Benefits from alternative C would lessen from increases in public use and construction activities.</p> <p>Designation of a 593-acre RNA would benefit wetlands and associated rivers and streams by limiting human intervention, preserving wetland plant communities and rare plant species.</p> <p>Additional trail, road (Camp 70 improvement) and infrastructure construction would increase potential for short-term effects to hydrology and water quality from soil erosion and siltation.</p> <p>Impacts of a refuge-run shuttle service would increase in comparison to alternative B by expanding the number of days in operation.</p> <p>Impacts to the refuge's water resources would increase from opening a 2,330-acre off-trail use zone. To minimize impacts, only 25 special use permits will be issued per month during the refuge's hunting season. Information obtained from special use permits will allow refuge personnel to monitor and perform remediation.</p>	<p>Alternative D would have impacts from increased visitation and outreach efforts similar to alternative A.</p> <p>Alternative D would have benefits from designating a RNA</p> <p>Impacts from construction and a refuge-run shuttle service are similar to alternative B.</p> <p>There is no off-trail use zone in alternative D so degradation of water resources would be eliminated.</p>

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
Soils			
<i>Impacts that would not vary by Alternative</i>			
<p>Maintaining native vegetation cover in all alternatives will stabilize soils and minimize erosion. Adverse impacts to soils would likely occur from restoration activities, habitat management, invasive species control, refuge infrastructure construction, and activities related to wildlife observation and photography. To minimize impacts, we would use best management practices; conduct all prescribed burns under a strict prescription and in optimal weather conditions; permit haying and mowing only in dry grassland areas and only on a rotational basis; use approved herbicides to control invasive plants; and limit public use to designated areas or zones.</p>			
<p>Soil stability has improved since refuge acquisition due to the prohibition of all vehicles from sensitive habitats and allowing vehicle access only on designated roads.</p> <p>Minor, short-term, localized soil disturbance (i.e., compaction, erosion) from native species replanting, prescribed burning, haying/mowing, herbicide application, hydroaxing and heavy equipment use, and other management practices. The refuge will follow best management practices (BMPs) to minimize impacts to soils.</p> <p>Visitor use in the form of hiking, biking, and horseback riding would impact soils through compaction, erosion, and sedimentation. Impacts are minimized by using a trail/route checklist to determine whether an existing or new trail meets established criteria.</p> <p>The refuge is most constrained under alternative A from implementing methods to reduce soil loss from wetland areas impacted by erosion and sedimentation.</p>	<p>Alternative B would increase long term benefits to soils through reclamation of natural soil productivity on restored wetlands and uplands, and obliterating, recontouring and revegetating old logging roads and trails.</p> <p>Minor short-term, localized soil compaction and long-term loss of productive soil where soils are removed or surfaced for visitor infrastructure and trails. No construction except boardwalk pilings for trail access would be done in wetlands; boardwalks over saturated areas would protect wetland soils and sensitive vegetation.</p> <p>A refuge-run shuttle service would increase the potential for soil sedimentation and streambank erosion.</p>	<p>Benefits to soils from alternative C would lessen from increases in public use and construction activities.</p> <p>Additional trail (Brown Mountain overlook to A-Frame Road), road (Camp 70 improvement), and infrastructure construction would increase potential for short-term localized impacts to sensitive wetland soils. To minimize long-term impacts no construction except boardwalk pilings for trail access would be done in wetlands; boardwalks over saturated areas and a bridge over the Little Blackwater River would protect wetland soils and sensitive vegetation.</p> <p>Increased potential for soil sedimentation and streambank erosion because of the off-trail use zone and the expanded time frame for the refuge-run shuttle service.</p>	<p>Impacts to soils are similar to alternative B. However, soils would benefit from a decrease in trail miles, limiting vehicle access, and limiting visitor use to designated roads and trails.</p>

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
<p>Socioeconomic Environment</p> <p><i>Impacts that would not vary by Alternative</i></p>			
<p>Total economic impacts associated with refuge operations across all alternatives represent well less than one percent of total income and total employment in the overall Tucker County and the city of Elkins economy. Total economic effects of refuge operations play a much larger role in the Canaan Valley communities near the refuge such as Davis, Thomas and Parsons where most of the refuge's public use related economic activity occurs. For social impacts, there are no actions that would not vary by alternative.</p>			
<p>Refuge management activities directly related to all refuge operations generate an estimated \$1.62 million in local output, 15.6 jobs and \$344 thousand in personal income in the local economy. Including direct, indirect, and induced effects, all refuge activities under alternative A would generate total economic impacts of \$1.95 million in local output, 20.9 jobs and \$442.7 thousand in personal income.</p> <p><i>Hunting:</i> Hunting helps maintain healthy animal populations, reduces deer browse, and supports a local cultural activity. Although some members of the public may consider the use of pursuit dogs inhumane, that issue was not commonly mentioned during public scoping. Permitting hunters off-trail and permitting hunting dogs off-leash may be seen as unfair to non-hunters who are required to stay on trails and keep dogs leashed. Although user conflicts may arise between hunters and non-hunters in some parts of the country, it has not been an issue at this refuge. Safety issues are minimized by enforcing State and refuge hunting regulations.</p>	<p>Refuge management activities directly related to all refuge operations generate an estimated \$1.71 million in local output, 16.3 jobs and \$361.6 thousand in personal income in the local economy. Including direct, indirect, and induced effects, all refuge activities would generate total economic impacts of \$2.05 million in local output, 21.9 jobs and \$465.9 thousand in personal income.</p> <p><i>Hunting:</i> Same benefits as Alternative A, plus an increase in the available areas on the refuge that are open for hunting, and a shuttle service to transport bagged deer, would provide more hunting opportunities, could increase hunter satisfaction, and could encourage hunters who might not otherwise participate. Increasing the amount of area open to rifle hunting could result in user conflicts between hunters and non-hunters, but since user conflicts generally do not occur on this refuge, it is unlikely that modifying the rifle zones will have any impact on the relationship between these user groups. Requiring hunters to obtain a special use permit to hunt rabbit may result in some inconvenience for hunters, but it is necessary for gathering more information about the valley's rabbit population.</p>	<p>Refuge management activities directly related to all refuge operations generate an estimated \$1.93 million in local output, 18.4 jobs and \$405.5 thousand in personal income in the local economy. Including direct, indirect, and induced effects, all refuge activities would generate total economic impacts of \$2.32 million in local output, 24.6 jobs and \$523.2 thousand in personal income.</p> <p><i>Hunting:</i> Same as alternative B.</p>	<p>Refuge management activities directly related to all refuge operations generate an estimated \$1.67 million in local output, 15.9 jobs and \$352.3 thousand in personal income in the local economy. Including direct, indirect, and induced effects, all refuge activities would generate total economic impacts of \$2.01 million in local output, 21.4 jobs and \$453.6 thousand in personal income.</p> <p><i>Hunting:</i> Same benefits as alternative B, however, eliminating some species from the hunt list may adversely impact hunters.</p>

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
<p>Socioeconomic Environment (cont.)</p> <p><i>Impacts that would not vary by Alternative (cont.)</i></p>			
<p>Total economic impacts associated with refuge operations across all alternatives represent well less than one percent of total income and total employment in the overall Tucker County and the city of Elkins economy. Total economic effects of refuge operations play a much larger role in the Canaan Valley communities near the refuge such as Davis, Thomas and Parsons where most of the refuge's public use related economic activity occurs. For social impacts, there are no actions that would not vary by alternative. (cont.)</p>			
<p><i>Fishing:</i> Participating in fishing events provide the benefit of connecting the community to the outdoors, which may lead to an increased appreciation of the refuge and its resources, and of the natural world in general. Fishing access is limited to places where roads or trails cross a waterway, which may limit opportunities for some visitors.</p>	<p><i>Fishing:</i> Increased benefits compared with alternative A, because in alternative B we would officially open the refuge to fishing and actively promote fishing and provide access, more signage, and education programs. Slightly increased adverse impacts compared with alternative A from enhancing and promoting the refuge's fishing program, which would require expenditures that could be used for other public benefits.</p>	<p><i>Fishing:</i> Same as alternative B</p>	<p><i>Fishing:</i> Increased benefits compared with alternative A because this alternative provides the opportunity to fish native-only streams, which may appeal to some anglers and may provide high-quality fishing experiences. Slightly adverse impacts because fishing may be limited and some anglers may choose to fish elsewhere.</p>

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
<p>Socioeconomic Environment (cont.)</p> <p><i>Impacts that would not vary by Alternative (cont.)</i></p>			
<p>Total economic impacts associated with refuge operations across all alternatives represent well less than one percent of total income and total employment in the overall Tucker County and the city of Elkins economy. Total economic effects of refuge operations play a much larger role in the Canaan Valley communities near the refuge such as Davis, Thomas and Parsons where most of the refuge's public use related economic activity occurs. For social impacts, there are no actions that would not vary by alternative. (cont.)</p>			
<p><i>Wildlife Observation & Photography:</i> Continuing to offer wildlife observation and photography opportunities on 31 miles of roads and trails may lead visitors to gain a deep appreciation for refuge resources. No increase in public use opportunities may lead to deterioration of the community's attitude towards and support for the refuge and its mission.</p>	<p><i>Wildlife Observation & Photography:</i> Increased benefits compared with alternative A because of increased infrastructure for public use, an additional 4.8 miles of trails, and more looped trails. This may increase visitation and improve visitor satisfaction, as well as increase return visits, which may positively impact the local economy. Revegetating the edges of some ski trails to improve habitat may be seen as beneficial from an ecological preservation perspective, but harmful from a recreational perspective because it would narrow ski trails. Increasing trail connectivity by building more trails may be seen as an adverse impact by visitors who are concerned with protecting wetlands and other resources. Additional visitor amenities may take funds away from other priorities, cause additional user conflicts, or cause more disturbance to wildlife, therefore diminishing the quality of wildlife viewing for others.</p>	<p><i>Wildlife Observation & Photography:</i> Increased benefits for recreational users compared to the other alternatives because there would be more trails miles and more trail connections, including a cross-valley trail. There would also be an off-trail use zone. The cross-valley trail may be cost-prohibitive to implement in a way that protects fragile wetland habitat. Of all of the alternatives, this alternative most increases access opportunities for mountain bikers, which may negatively impact hikers, horseback riders, and other user groups.</p>	<p><i>Wildlife Observation & Photography:</i> Closing some refuge trails would decrease access and connectivity in comparison to alternatives B and C.</p>

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
<p>Socioeconomic Environment (cont.)</p> <p><i>Impacts that would not vary by Alternative (cont.)</i></p>			
<p>Total economic impacts associated with refuge operations across all alternatives represent well less than one percent of total income and total employment in the overall Tucker County and the city of Elkins economy. Total economic effects of refuge operations play a much larger role in the Canaan Valley communities near the refuge such as Davis, Thomas and Parsons where most of the refuge's public use related economic activity occurs. For social impacts, there are no actions that would not vary by alternative. (cont.)</p>			
<p><i>Environmental Education and Interpretation:</i> This alternative exposes a large number of people to the refuge because of the emphasis on on-site and off-site programs. This could lead to a broader understanding of and support for the refuge mission and refuge resources. Recruiting local volunteers provides the benefit of keeping the visitor center open more days per week, which allows the refuge to provide programs and information on a more frequent basis. On and off-site programs entail additional budget costs and use resources that could be available for other refuge programs. Opening the visitor center only four days a week is of concern to members of the public who believe that the center should be open on weekend days, because that is the time of highest potential visitation.</p> <p><i>Outreach & Partnerships:</i> Beneficial impacts from using a variety of venues and forums to communicate with the public, which helps refuge staff develop relationships with a variety of individuals and groups. Minimal adverse impacts because outreach activities divert staff time and effort away from other management activities.</p>	<p><i>Environmental Education and Interpretation:</i> Increased beneficial impacts compared with alternative A because the refuge would provide additional interpretative trails and signs, thus increasing the quality of visitor experiences. Hiring additional staff for visitor services may also increase visitor satisfaction because of increased outreach to schools and increased opportunities to learn more about the refuge. Adverse impacts from expenses incurred from designing and maintaining additional interpretative trails and an environmental education pavilion, thus diverting resources from management activities. Also, increased use of the refuge may impact refuge resources and habitats.</p> <p><i>Outreach & Partnerships:</i> Increased beneficial impacts compared with alternative A, because the refuge would host an annual open house which would improve relationships with the community and provide mutual learning experiences. Adverse impacts are the same as alternative A.</p>	<p><i>Environmental Education and Interpretation:</i> Increased beneficial impacts compared with alternative B because the refuge would open the visitor center 7 days a maximum opportunities for visitation and may increase satisfaction with refuge services. Slightly increased adverse impacts compared with alternative B because it will cost more to operate an expanded public use program, thus diverting funds from other management activities.</p> <p><i>Outreach & Partnerships:</i> Same as alternative B.</p>	<p><i>Environmental Education and Interpretation:</i> Same as alternative B, except the closing of portions of some commercial cross-country skiing and snowshoeing trails may mean that the refuge would not be able to offer the same level of environmental education and interpretation programming during the winter at the White Grass location.</p> <p><i>Outreach & Partnerships:</i> Same as alternative B.</p>

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
Socioeconomic Environment (cont.) <i>Impacts that would not vary by Alternative (cont.)</i>			
Total economic impacts associated with refuge operations across all alternatives represent well less than one percent of total income and total employment in the overall Tucker County and the city of Elkins economy. Total economic effects of refuge operations play a much larger role in the Canaan Valley communities near the refuge such as Davis, Thomas and Parsons where most of the refuge's public use related economic activity occurs. For social impacts, there are no actions that would not vary by alternative. (cont.)			
<p><i>Staffing:</i> The current staffing level of 7 full-time employees and 2 term employees allows the refuge to stay within budget and does not require budget increases. However, current staff numbers are inadequate to perform all needed refuge functions.</p>	<p><i>Staffing:</i> Increasing staff to 12 full-time employees and one temporary employee increases the refuge's capacity to perform its functions and contributes to local employment and local economic development. However, funding additional positions would require a larger refuge budget, and may use funds that could be used to support other refuge activities.</p>	<p><i>Staffing:</i> Slightly increased beneficial and adverse impacts compared to alternative B from an increase of one employee.</p>	<p><i>Staffing:</i> Same impact as alternative B.</p>

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
Upland Habitats			
<i>Impacts that would not vary by Alternative</i>			
<p>Regardless of the alternative selected, we will use standard and effective habitat management techniques to conduct forest, shrubland, and grassland management activities in the refuge uplands. Whenever practicable, we will replace non-native plant species with native species to restore the ecological integrity of the refuge. Management activities would cause no major mortality or loss in local populations, because actions occur on a rotational basis, meaning no major habitat components would change completely in any one year. Continuing red spruce and balsam fir restoration would provide long-term benefits, outside the 15-year scope of this plan, to Cheat Mountain salamanders and West Virginia northern flying squirrels.</p> <p>Alternative A would benefit uplands through the continued management and protection of the refuge's 10,482 acres of northern hardwood forest, conifer spruce/mixed forest, shrublands, old fields and grasslands.</p> <p>Some risk of short-term, localized impacts on these habitats from native species replanting, prescribed burning, haying/mowing, herbicide application, hydroaxing and heavy equipment use, and other management practices. The refuge would use at a minimum all BMPs recommended by state, federal, and Non-Governmental Organizations</p> <p>The refuge protects and manages 6,616 acres of northern hardwood forest and conifer spruce/mixed forest. Red spruce and balsam fir restoration would provide long-term benefits by increasing forested acres.</p> <p>The refuge protects 3,335 acres of shrubland and old fields, and actively manages 35 acres that benefit wildlife species such as migratory songbirds and American woodcock.</p> <p>Managing up to 531 grassland acres on a rotational basis would provide a habitat mosaic benefiting multiple wildlife and plant species and providing cover for breeding and migrating birds.</p>	<p>In addition to alternative A, alternative B would increase management and restoration efforts in uplands.</p> <p>Increasing the harvest of white-tailed deer would further benefit upland plant communities.</p> <p>Impacts to upland habitats and associated wildlife would increase with increased number of trails, trail miles, visitor infrastructure, and increased visitor use.</p> <p>Increasing conifer spruce/mixed forest habitat, reforesting logging roads, and incorporating silvicultural methods in stand management would benefit forests by improving stand health, reconnecting fragmented forest blocks, and increasing overall acreage.</p> <p>Conversion of forest islands and edges to early-successional habitat would benefit associated species, like American woodcock and Eastern towhee.</p> <p>Early-successional focal species would benefit most from actively managing 853 acres of shrubland habitat, which includes allowing succession to occur on 216 acres of grassland.</p>	<p>Impacts to upland habitats and associated wildlife would be greatest in alternative C with increased number of trails, trail miles, visitor infrastructure, access to an off-trail use zone, and increased visitor use.</p> <p>Benefits to upland forests are similar to alternative B although forest stands would not benefit from forest stand improvement measures and would be reliant on white-tailed deer harvest.</p> <p>The range of red spruce would continue to expand toward pre-20th century conditions but at a much slower rate than in the other alternatives.</p> <p>Impacts to shrubland habitats would be similar to alternative B.</p> <p>Impacts to grassland habitats would be similar to alternative B.</p>	<p>Alternative D would provide the greatest benefit to forested habitats through passive management to achieve late-successional forest characteristics.</p> <p>Increased flexibility in the control of white-tailed deer would be most beneficial to refuge plant communities and associated wildlife.</p> <p>Long-term benefits to upland forests would increase in comparison to alternative B from an increase in forested acres relating to succession of shrubland, old field, and grassland habitats.</p> <p>Early successional and shrubland dependant species would receive short-term benefits from succession but ultimately would be displaced as habitats continue to succeed to northern hardwood forest. Displacement may adversely affect local and regional population goals set by the BCR.</p> <p>Certain populations of rare plant communities and plant species, like glade spurge, would be affected by reducing extent and frequency of occurrence. A management plan to minimize affects to glade spurge populations will be developed.</p>

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
Upland Habitats (cont.)			
<i>Impacts that would not vary by Alternative (cont.)</i>			
<p>Regardless of the alternative selected, we will use standard and effective habitat management techniques to conduct forest, shrubland, and grassland management activities in the refuge uplands. Whenever practicable, we will replace non-native plant species with native species to restore the ecological integrity of the refuge. Management activities would cause no major mortality or loss in local populations, because actions occur on a rotational basis, meaning no major habitat components would change completely in any one year. Continuing red spruce and balsam fir restoration would provide long-term benefits, outside the 15-year scope of this plan, to Cheat Mountain salamanders and West Virginia northern flying squirrels. (cont.)</p>	<p>The conversion of 215 grassland acres to shrubland habitat would be considered adverse to the overall objective of maintaining the grassland cover type. Impacts would be negligible because the refuge will concentrate on providing higher quality grassland habitat through reducing interior fragmentation and managing in ≥50 acre habitat blocks.</p>		<p>Alternative D would provide the least benefit to grasslands as they would not be managed and would succeed through the successional stages, eventually displacing grassland dependent wildlife species. Grassland- and area-dependent species (e.g. Henslow's sparrows) would benefit in the short-term but would be displaced within 10 years.</p>

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
<p>Freshwater and Wetland Habitats</p> <p><i>Impacts that would not vary by Alternative</i></p>			
<p>Regardless of which CCP alternative we select, we would develop a Habitat Management Plan for wetland habitats, and we would mitigate any potential for major unplanned changes in vegetation by continuously monitoring our vegetation types and updating our Geographic Information System database. A trapping program in all alternatives would maintain furbearer populations at levels compatible with the habitat and with refuge objectives, and minimize beaver damage to plant communities and refuge roads and trails. Indirect impacts could result from the activity of placing traps as it could disturb or displace migratory birds utilizing wetlands for wintering or foraging habitat during seasonal migrations. Direct impacts would include the harvest of targeted species, and the potential to harvest non-targeted species.</p>			
<p>Alternative A would benefit wetlands through the continued management and protection of 5,573 acres. Rare plant communities would benefit from active habitat management such as beaver trapping and the harvest of white-tailed deer.</p> <p>Over the long-term, the risk of erosion and water quality problems would increase with increased visitor use. However, impacts are minimized because visitor use is limited to designated roads and trails.</p> <p>Some risk of short-term, localized impacts on these habitats from native species replanting, prescribed burning, haying/mowing, herbicide application, hydroaxing and heavy equipment use, and other management practices. The refuge would use at a minimum all BMPs recommended by state, federal, and Non-Governmental Organizations. Impacts would be minimized by conducting operations when the ground is frozen, hand carrying equipment and using chainsaws rather than using heavy equipment for planting activities whenever possible.</p> <p>The 347 acres of forested wetlands would receive long-term benefits from red spruce and balsam fir planting efforts by improving forested wetland habitat and increasing overall acreage.</p>	<p>Benefits would increase in alternative B through the remediation of impacted wetland areas, increased harvest of white-tailed deer, designating a 754-acre RNA, and the development of an ecological integrity index that would improve wetland function and monitor changes in relation to climate change and restoration activities.</p> <p>There would be short-term impacts from trail, environmental education pavilion, and boardwalk construction to wetlands and long-term impacts from habitat loss where trails cross wetlands. The refuge will use BMPs for construction to minimize impacts to wetlands and the Blackwater River.</p> <p>Benefits to forested wetlands are similar to alternative A.</p> <p>Skidsteer vehicles would be used to construct white-tailed deer exclosures. The refuge would limit the extent and duration of use in wetter soil types to minimize impacts, and it would use additional measures (e.g. using rubber mats) to minimize impacts. Short-term impacts would be offset by long-term benefits to red spruce and balsam fir stands by increasing seedling survival rates and stand acres.</p>	<p>Additional trail (Brown Mountain overlook to A-Frame Road), road (Camp 70 improvement) and infrastructure construction would increase potential for short-term localized impacts to sensitive wetlands that contain rare and sensitive plant communities. To minimize long-term impacts on the Brown Mountain Overlook to A-Frame road trail, the refuge would construct a boardwalk in areas where sensitive wetland soils and plants would be affected by foot traffic and a bridge will be placed over the Little Blackwater River where the riverbank would be susceptible to erosion.</p> <p>Designation of a 593-acre RNA would benefit wetlands and associated rivers and streams by preserving wetland plant communities and rare plant species.</p> <p>Impacts of dispersed use within the off-trail use zone would be minimized as wetlands consist of only 4% of the total area.</p> <p>Impacts to forested wetlands are similar to alternative B.</p> <p>Impacts to forested wetlands-aspen woodlands are similar to alternative B.</p> <p>Impacts to open water and aquatic habitats are similar to alternative B.</p>	<p>Benefits in alternative D are similar to alternative B.</p> <p>Impacts would not be as extensive as alternative B or C because some trails would be closed and visitors would be restricted to designated trails. This would benefit associated wetlands by limiting disturbance and the spread of invasive species.</p> <p>Benefits to forested wetlands include an increase in overall size from passive management, thus expanding a globally rare community type.</p> <p>Impacts to aspen woodlands are similar to alternative D.</p> <p>Impacts to shrub and herbaceous wetlands are similar to alternative B.</p> <p>Impacts to open water and aquatic habitats are similar to alternative B.</p>

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
Freshwater and Wetland Habitats (cont.) <i>Impacts that would not vary by Alternative (cont.)</i>			
Regardless of which CCP alternative we select, we would develop a Habitat Management Plan for wetland habitats, and we would mitigate any potential for major unplanned changes in vegetation by continuously monitoring our vegetation types and updating our Geographic Information System database. A trapping program in all alternatives would maintain furbearer populations at levels compatible with the habitat and with refuge objectives, and minimize beaver damage to plant communities and refuge roads and trails. Indirect impacts could result from the activity of placing traps as it could disturb or displace migratory birds utilizing wetlands for wintering or foraging habitat during seasonal migrations. Direct impacts would include the harvest of targeted species, and the potential to harvest non-targeted species. (cont.)			
Selective patch cuts within acres of aspen woodlands would create short and long-term benefits by improving habitat for a diversity of wildlife species and focal wildlife species. Benefits to rare plant communities and wildlife from beaver management of 685 acres and 55 stream miles outweigh decreased open water acreage that will result from beaver management activities.	Aspen stand management and establishment of demonstration sites would cause short-term negligible, localized impacts. Impacts to open water and aquatic habitats are similar to alternative A. Reforestation of riparian corridors would increase benefits to riparian wetlands by improving connectivity and increasing corridor width. Disturbance to wildlife and plant species would be minimized by protecting beaver ponds and adjacent habitats from disturbance.		

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
Fisheries Habitats and Resources <i>Impacts that would not vary by Alternative</i>			
Regardless of which management alternative we select, the Blackwater River watershed fisheries will continue to benefit from Service protection of the part of the watershed that provides good cover, food, and breeding habitat. Prescribed burning to maintain grasslands and silvicultural practices used to restore and enhance upland forested ecosystems may cause short-term, minimal, localized increases in turbidity. Controlling invasive plants with herbicides would not affect fisheries because the herbicide we would use is not toxic to fish or invertebrates, and quickly absorbs to suspended and bottom sediments. A law enforcement presence would help prevent the illegal taking of fish, littering, or trespassing.			
<p>Protecting 166 acres of streams, rivers, and open water within the Blackwater River watershed will benefit refuge fisheries watershed protection.</p> <p>Stocking non-native brown trout impacts native brook trout populations by shifting microhabitat use, altering vertical distribution, and in some cases has preceded the disappearance of native brook trout populations.</p> <p>Refuge visitors who boat and fish may cause localized, minor, short-term impacts by disturbing the bottom substrate in shallow areas. Discarded items such as fishing line, lures, and plastic containers present a risk for waterfowl and other birds. Brochures and signage would notify those visitors of proper precautions, including retrieving broken line and lures and carrying out all trash.</p>	<p>Short and long-term benefits to refuge fisheries would be expected from wetland and riparian area restoration activities.</p> <p>Increasing visitor use would directly impact native fish populations through increased fishing pressure and indirectly through trail degradation at river and stream crossings.</p> <p>Construction and restoration projects may cause localized, short-term effects to fish populations through increased soil erosion and sedimentation into refuge waterways. The refuge will adhere to BMPs to minimize any potential impacts.</p>	<p>Benefits from alternative C, although similar to alternative B, would lessen in the short-term from increased refuge construction projects and in the long-term from increased visitor use.</p>	<p>Benefits from alternative D are the same as alternative B plus:</p> <p>Increased benefits to native fish from limited vehicle access, decreased trail miles, decreased visitor use, and working with WVDNR to stock native fish in the Blackwater River.</p>

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
Threatened and Endangered Species <i>Impacts that would not vary by Alternative</i>			
<p>In all alternatives, the refuge will continue to protect known populations of Cheat Mountain salamanders and continue to conduct surveys to locate undocumented populations. Cheat Mountain salamander monitoring and research, conducted by the refuge and partners, will continue to focus on better understanding their habitat limitations, ways to improve their habitat, and mitigation to further recovery efforts on the refuge and other sites where populations are known or are likely to occur. On the refuge, long-term benefits to Cheat Mountain salamander populations are expected from red spruce restoration projects designed to increase acreage and connectivity of suitable habitat where populations have been documented. Under all alternatives, the continued maintenance of commercial cross-country skiing and snowshoeing trails would perpetuate a narrow trail corridor through occupied salamander habitat. However, the corridor itself is not considered suitable living habitat for the salamander and it is anticipated that the presence of the corridor does not completely limit movements across this trail. The refuge will continue monitoring efforts for Indiana bats to determine foraging locations and extent of use on the refuge and conduct mist-netting surveys to verify presence of Indiana bats under all alternatives.</p>			
<p>Long-term benefits to Cheat Mountain salamander populations are expected from red spruce restoration projects by increasing acreage and connectivity of suitable habitat.</p> <p>Indiana bat surveys would increase knowledge of their presence and habitat use, providing long-term benefits by focusing restoration on their habitat requirements. If roosting colonies exist on the refuge, disturbance from visitor use would affect Indiana bats.</p>	<p>Additional benefits to Cheat Mountain salamander populations would be expected from reforestation of logging roads and edges of cross-country ski trails (Powderline and Three-Mile), and installing trail diverters.</p> <p>Restoration in riparian, early-successional and forested wetland habitats would benefit Indiana bats by increasing and improving foraging habitat.</p> <p>The refuge's management activities are not likely to adversely affect Cheat Mountain salamanders or Indiana bats.</p>	<p>Benefits and impacts are similar to alternative B for Cheat Mountain salamanders.</p> <p>If Indiana bat maternity or roosting colonies exist within the off-trail use zone (open during hunting season), visitor disturbance could affect those colonies. The refuge will minimize impacts by increasing monitoring efforts to determine Indiana bat presence.</p>	<p>Alternative D would have the greatest long-term benefits to Cheat Mountain salamanders. Immediately closing and completely reforesting Powderline and Three-Mile cross-country ski trails would recreate microhabitat conditions necessary for salamander occupation.</p> <p>Benefits to Indiana bats would be similar to alternative B.</p>

Alternative A: Current Management	Alternative B: Species Focus	Alternative C: Emphasis on Expanding Priority Public Uses	Alternative D: Focus on Managing for Historic Habitats
Public Use and Access			
<i>Impacts that would not vary by Alternative</i>			
<p>Regardless of alternative, we would continue to allow compatible, wildlife-oriented public uses including hunting, fishing, observing, and photographing wildlife through hiking, biking, vehicle driving and horseback riding. We would also continue to allow cross-country skiing and snowshoeing to facilitate wildlife observation and photography in the winter, when access on foot is difficult. We would continue to provide the public with wildlife interpretation and environmental education opportunities. To support public use, we would continue to maintain the refuge facilities including the refuge headquarters, visitor's center, parking lots, observation platforms, hunt blinds, kiosks, and trails. We will evaluate public use sites and programs periodically to assess whether they are meeting the objectives, and to prevent site degradation. A refuge trail monitoring plan addresses the potential physical impacts of trail beds, including percent trail incision, exposed roots and puddles.</p>			
<p>The refuge would continue to allow compatible, wildlife oriented public uses including hunting, fishing, observing and photographing wildlife through hiking, biking, and horseback riding. We also allow cross-country skiing and snowshoeing to facilitate wildlife observation and photography in the winter.</p> <p>Adverse impacts from permitting leashed dogs to accompany visitors on refuge trails are the greatest under this alternative because there is no stipulation on leash length.</p>	<p>Increased visitation and increased opportunities for consumptive and non-consumptive uses would combine to increase the risk of human-wildlife conflicts and habitat damage, minor accidents that will require law enforcement assistance, and parking issues during times of heavy use.</p> <p>Leash length for dogs would be 8 feet, thus minimizing the zone of disturbance from dogs who accompany visitors.</p>	<p>Impacts are similar to alternative B. However, the extent of impacts and disturbance to wildlife and habitats would increase from: an off-trail use zone, additional trail construction and use, and increased visitation by consumptive and non-consumptive users.</p> <p>Adverse impacts from permitting leashed dogs to accompany visitors on refuge trails are the same as alternative B.</p>	<p>Alternative D would have benefits and minimal impacts similar to alternative A.</p> <p>Adverse impacts from permitting leashed dogs to accompany visitors on refuge trails are the same as alternative B.</p>