Final Environmental Assessment for Land Management

National Conservation Training Center
United States Fish and Wildlife Service
Shepherdstown, West Virginia

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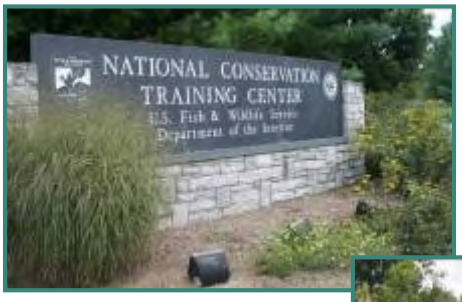

Note to Readers

This *Final Environmental Assessment for Land Management at the National Conservation Training Center* contains changes that reflect public comments on the draft environmental assessment (EA). One significant change made in response to comments was to reconsider prescribed burning in woodland areas as a possible activity. This was previously discussed as a possibility and had been included in the effects analysis, but did not appear in the Alternative C discussion in the draft EA under "Proposed Activity 3—Use prescribed fire to control or suppress invasive/exotic plant species and reduce ground and ladder fuels." The effects analysis for this proposed activity was also re-inserted into the "Habitat and Wildlife" section of chapter 3; however, the draft EA did contain discussions of the effects of prescribed fire on the other resource topics. Other changes include more emphasis on wildfire as a potentially destructive force, as well as the potential beneficial effects of fire.

NATIONAL CONSERVATION TRAINING CENTER
FINAL ENVIRONMENTAL ASSESSMENT FOR LAND MANAGEMENT

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The United States Fish and Wildlife Service (FWS) has prepared this environmental assessment for the National Conservation Training Center (NCTC) to present various management strategies to control invasive plant species, promote the growth of native plants, control other pests, and prepare for a potential wildfire. The FWS is proposing various treatment methods (such as manual, mechanical, biological, cultural, chemical, and prescribed fire) to achieve management objectives.

Alternative A: No Action—Continue Current Level of Land Management

The no-action alternative for this EA is described as continuation of the current level of management.

Grassland Areas. The overall management objective for grassland habitat (other than areas planned for reforestation) is to restore the former agricultural fields to a native grassland biological community to provide optimum feeding, breeding, and wintering habitat for a diversity of grassland-dependent migratory birds, native pollinating invertebrates, and other native wildlife that are present. This would be accomplished through continued haying, mowing, planting desired species, and chemically treating undesirable species.

Mixed-deciduous Forest Areas. The overall management objective for the forest areas is to protect or re-establish desired species, eradicate undesirable species, and protect forested areas from unplanned ignitions. This would be accomplished through re-establishing desired species and chemically treating undesirable species

Wetland/Riparian Areas. The overall management objective for riparian/wetland areas is to protect, maintain, and enhance the biological diversity of riparian/wetland areas. This would be accomplished through planting desired species and chemically treating undesirable species.

Alternative B: Cease All Land Management Activities

This alternative proposes that the NCTC would stop all land management actions—this includes mowing, haying, planting desired species, and chemically treating undesirable species.

Alternative C: Proposed Action (Preferred Alternative)

The same management actions (except haying) that would continue under Alternative A would also continue under Alternative C. The new proposed activities under Alternative C are the use of prescribed fire to control weeds and woody vegetation, over time, and reduce litter buildup (ground fuels) and ladder fuels; and actions to control "other pests." The overall management objectives for controlling other pests are to prevent unacceptable damage or impediment to forests, grasslands, and riparian areas; habitat restoration sites; landscaped areas; and roads, sidewalks, trails, fences, buildings, and other facilities; protect human health and ensure the safety of workers, staff, and guests; and protect habitat and other environmental factors in the process of conducting control measures. This would be accomplished through use of cultural and mechanical controls and chemically treating undesirable species.

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Chapter 1. Purpose and Need for Action

1.1 Introduction

Construction of the National Conservation Training Center (NCTC) commenced in 1994, and the first onsite training courses began in fall of 1997. The primary purpose of NCTC is to enhance conservation of fish, wildlife, and their habitats through leadership in conservation education for the public; training for the conservation and resource management community; and fostering alliances among diverse interests.

The United States Fish and Wildlife Service (FWS) has prepared this environmental assessment (EA) for the NCTC to present various management strategies to control invasive plant species, promote the growth of native plants, control other pests, and prepare for a potential wildfire. The FWS is proposing various treatment methods (such as manual, mechanical, biological, cultural, chemical, and prescribed fire) to achieve management objectives. The environmental assessment process has been conducted in accordance with Council on Environmental Quality (CEQ) regulations for implementing the *National Environmental Policy Act* (NEPA; 40 Code of Federal Regulations [CFR] 1500).

The 532-acre NCTC is located approximately three miles north of Shepherdstown, West Virginia, along the Potomac River, which forms its northern boundary. Terrapin Neck Road forms the eastern boundary of the property, with Shepherd Grade Road forming the southwest border (see Maps A-1, A-2, and A-3; note that all maps are located in Appendix A).

1.2 Environmental Assessment Goal and Project Objectives

1.2.1 Environmental Assessment Goal

The overall goal of this EA is to present an ecosystem-based approach for protecting resources, restoring and enhancing ecosystems, and providing conditions that support biological diversity at the NCTC. Following completion of the final EA, the FWS's selected alternative will become a basis for NCTC's Land Management Plan and other "step-down" plans (such as the Fire Management Plan) that will address more specific aspects of land management.

1.2.2 Importance of Defining Project Objectives

Objectives are specific statements of purpose that support the goals an alternative must meet, to a large degree, for the planning and environmental analysis process to be considered a success. Meeting objectives to a large degree is part of what makes an alternative "reasonable." Objectives also help resolve the need for action.

The decision maker will use the proposal objectives, together with potential environmental effects, as evaluation criteria to select the alternative that best fulfills the proposal's objectives and satisfactorily meets environmental guidelines.

1.3 Purpose of and Need for Management Actions at the NCTC

Three primary objectives are presented for management actions at the NCTC based on the purpose and need for the project and FWS direction. The following three objectives guided the development of the Proposed Action (Alternative C):

1. protect and restore the ecological integrity of the native biological communities occurring at the NCTC

2. restore, maintain, and increase native habitat to support a diversity of wildlife occurring at the NCTC

3. protect NCTC assets (structures and natural resources) from a potentially devastating wildfire

The following section summarizes the need for action (based on existing conditions) to demonstrate the link between those conditions and the purpose (objectives) of management actions at the NCTC. Detailed descriptions of existing conditions for seven resource topics are contained in "Chapter 3: Affected Environment and Environmental Consequences."

OBJECTIVE 1. Protect and restore the ecological integrity of the native biological communities occurring at the NCTC.

Need (Existing Conditions). Nonnative plants have become established and continue to be introduced to NCTC lands via birds; seeds that are carried by wind; and seeds or plant parts that hitchhike on animals, people, vehicles, and equipment; or by water via the Potomac River. Treatment actions are needed because invasive native and nonnative (also referred to as exotic or alien) plants are out-competing native vegetation for resources (sunlight, soil moisture, and nutrients) and displacing native plants and changing species composition, vegetation structure, and soil chemistry. Invasive plants have taken over to a degree that they have become the dominant vegetation in some areas at the NCTC. This has created a monoculture (plants of only one species in a particular area) in some areas rather than an ecosystem that supports plant and animal diversity. The replacement of native plants with nonnative plants is causing adverse effects because native insects, birds, and animals are adapted to living and reproducing along with native plants. Native insects, birds, and animals sometimes readily feed or reproduce on nonnative plants, leading one to think that this is beneficial. However, this can negatively affect their diet, lead to mortality or reproductive failure, make them vulnerable to pests and predators, or prevent the pollination or seed dispersal of native plants.

OBJECTIVE 2. Restore, maintain, and increase native habitat to support a diversity of wildlife occurring at the NCTC.

Need (Existing Conditions). There is a need to restore native vegetation to the type that would normally be found at the NCTC. Prior to the establishment of the NCTC, past land use practices altered vegetation from its original conditions. The loss of native vegetation has occurred over the years, primarily through farming, which included vegetation clearing, cultivation, planting of

nonnative grasses for grazing and hay production, and grazing. The loss of native vegetation has also been the result of fire exclusion.

Grassland Areas. There is a need to restore former agricultural fields to a native grassland biological community to provide favorable feeding, breeding, and wintering habitat for a diversity of grassland-dependent migratory birds, native pollinating invertebrates, and other native wildlife that are present (see the "Habitat and Wildlife" section in Chapter 3 and Appendix B).

Mixed-Deciduous Forest Area. There is a need to maintain, protect, restore, and increase diversity in a native mixed-deciduous forest biological community. This community, which is in decline in the mid-Atlantic region, provides feeding, resting, breeding, and wintering habitat for a diversity of native forest-dwelling birds, mammals, reptiles, amphibians, and invertebrates.

Riparian/Wetland Areas. There is a need to protect, maintain, and restore the riparian and wetland habitat areas. The term "riparian" refers to land adjacent to waterways. Three streams, nearly one mile of Potomac riverfront, one spring-fed pond, and five stormwater management ponds provide an important riparian and wetland habitat component to the NCTC landscape. Much of the biological diversity on the NCTC property can be found in these areas.

Other Pests. There is a need to control insects, diseases, rodents, and similar organisms (mostly nonnative ones, although native organisms may also need to be controlled in certain situations) that harm or threaten to harm plants, animals, and other native biota or that pose a risk to facilities or human health.

OBJECTIVE 3. Protect NCTC assets (structures and natural resources) from a potentially devastating wildfire.

Need (Existing Conditions). The NCTC needs to prepare for weather conditions that can increase the potential for a devastating wildfire on NCTC lands or from a fire off NCTC property that could spread to the NCTC. In annual terms the average fire danger rating is low. The fire danger rating in spring and fall mostly varies from low to moderate, with some days high, very high, or extreme — usually when windy on top of other conditions such as lack of precipitation, low humidity, and higher temperatures. For example, the drought conditions experienced during the summer of 2010 can extend and amplify the fire season and danger rating. The conditions the NCTC needs to prepare for are referred to as "90th percentile weather conditions." These conditions are described as the highest 10 percent of fire weather days where fuel moisture, temperature, relative humidity, and wind speed are only exceeded 10 percent of the time based on historical periods of weather observations. Preparing for a potential wildfire includes measures such as reducing or removing excessive ground and ladder fuels, providing access, creating fire breaks and defensible space, reducing potential for unplanned fires to start, and making sure that properly trained and equipped personnel are prepared to respond.

There is a need to protect significant values in the NCTC campus core area (102 acres), as well as the 4-acre Hendrix in-holding (comprised of two homes, a barn, and other small outbuildings) from a devastating wildfire. There are 20 major FWS-owned structures in the core campus area, which include an information/reception/museum building, two instructional buildings, a science laboratory, an audio-visual production facility, four lodges, the commons, the Children's Treehouse Child

Development Center (Children's Center) for employees and some residents, and utility and maintenance facilities. The estimated replacement cost of government-owned facilities at the NCTC is approximately $575 million.

There is a need to protect the 430 acres outside the core campus area, which are managed primarily as wildlife habitat. The habitats include open fields and meadows, patches of deciduous forest in various successional stages, the riparian edge of the Potomac River, springs, creeks, ponds, small wetlands, and limestone cliffs.

1.4 Management Direction that Influences the Scope of this Environmental Assessment

1.4.1 Land and Resource Management Planning Documents

Each FWS unit is responsible for land management planning, including setting land use goals and objectives, implementing appropriate actions to accomplish the objectives, achieving outcomes and results, and evaluating the outcomes and results against the intended objectives.

Once this EA is finalized and approved, the management actions contained in the selected alternative will become the NCTC Land Management Plan, which will be a step-down plan of the NCTC Master Plan and its EA (USFWS 1992). The purpose of the Land Management Plan is to guide the management, protection, and restoration of wildlife habitat and protection of significant values at the NCTC. The long-range plan will be evaluated after 15 years, but may be updated earlier as better management information is developed or resource priorities change. Several landscape-scale conservation plans and other documents were reviewed, and where appropriate, habitat and population objectives were integrated into this EA.

The NCTC conducts other activities that do not require environmental analysis (and are therefore not discussed in this EA) but will be included in the Land Management Plan; those activities are

- planting and maintenance of lawns, gardens, flower beds, and other landscape areas
- removal or trimming of hazardous trees, based on an annual survey and ongoing observations of the heavily used campus zone, hiking trails, fences, power lines, and similar areas
- maintenance of fences, roads, trails, recreational features, structures, and similar areas

1.4.2 National Environmental Policy Act

NEPA requires all federal agencies to initiate interdisciplinary planning that considers and discloses environmental effects in their decisions. To meet NEPA requirements, federal agencies must prepare a statement that describes the effects of federal actions; this can be accomplished through an EA, environmental impact statement, or categorical exclusion. The FWS determined that an EA was the appropriate level of analysis for the NCTC. This EA has been prepared under CEQ regulations for implementing NEPA at 40 CFR 1501.2 and 1501.3.

1.4.3 Fire Management Direction and Policies

NCTC's Fire Management Plan will meet the policy and direction of the National Fire Plan by emphasizing the primary goals of the *10-Year Comprehensive Strategy and Cohesive Strategy for Protecting People and Sustaining Natural Resources*, as described in the FMP. Among other policies, the FMP also incorporates and adheres to the Department of the Interior policy stated in 620 Department Manual 1 by giving full consideration to use of wildland fire as a natural process and tool during the land management planning process. The Department of the Interior and FWS requires that every area with burnable vegetation have an approved Fire Management Plan that describes actions to prepare for and respond to a wildfire (fire suppression), to plan and conduct prescribed fires, and to complete other fire management business. NCTC's Fire Management Plan will be a step-down plan to this EA.

1.5 Decision to Be Made

The Responsible Official (decision maker) for this action is Mr. James (Jay) Slack, NCTC Director. The decision maker will consider how well each alternative meets the objectives (purposes) described above in section 1.3 and satisfies the need for land management actions, and how well this EA addresses the issues presented during the scoping process (see Appendix C). The decision maker's decision, based on this final EA, is presented in the "Finding of No Significant Impact" that accompanies this final EA.

1.6 Project Schedule

Now that the final EA and Finding of No Significant Impact have been issued, site-specific treatment planning can now commence. The Fire Management Plan and related prescribed burn plan will also be finalized soon, with prescribed burns being implemented sometime in spring 2011.

1.7 Public Participation and Information

NEPA, and the CEQ regulations that implement the act, require public participation during the environmental assessment process.

1.7.1 NEPA Scoping Process

Scoping is described in CEQ's NEPA implementing regulations as an early and open process to ensure that the full range of issues related to a proposed action are addressed and that all significant issues are identified. Scoping also provides the opportunity for agencies, elected officials, members of the public, and American Indian tribes to present additional background and technical information.

The FWS mailed 110 postcards announcing the scoping information meetings and placed ads in local newspapers. The ad in *The Journal* (Martinsburg) appeared on October 15, 16, and 22, 2009; and the ad in the *Shepherdstown Chronicle* appeared on October 16 and 22, 2009. An announcement was also posted on the NCTC website for public view, and notice was sent to all NCTC staff via email.

Scoping information meetings were held on October 29, 2009, at the NCTC. There were two sets of meetings that day: the morning meeting was for staff members of the NCTC and other agencies; the evening meeting (6:30 pm – 8:30 pm) was for the benefit of the public and local, state, and other federal agency representatives who did not attend the morning meeting. The official close of the scoping comment period was November 13, 2009, but comments are welcome throughout the environmental analysis process for this EA.

1.7.1.1 What Was Learned During Scoping

The CEQ regulations that implement NEPA guide federal agencies in handling nonsignificant issues by directing them to "identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review" (CEQ section 1506.3; 40 CFR 1501.7). Issues that are not significant are those that are (1) already addressed by law, regulation, or other higher level decision; (2) beyond the scope of the purpose and need identified for the project; (3) not connected to the proposed action; (4) conjectural and not supported by scientific or factual evidence; or (5) irrelevant to the decision to be made.

Significant Issue. No significant issues relative to the EA process were expressed during the scoping period. One commenter stated that the "front hayfield south of the entrance gate could be restored to a more attractive open savanna environment." Another commenter stated that the "haying . . . creates fairly large expanses that are relatively uniform in vertical structure" in that they don't "generally create habitat for many grassland birds." These comments, though helpful, were not considered significant during the formal scoping period.

The continuation of harvesting hay at the NCTC has been under consideration for some time. With input from NCTC staff, other subject matter experts within the FWS, and members of the local chapter of the Audubon Society, it was determined that, due to wildlife habitat concerns, continuing to harvest hay at the NCTC may not be in the best interest of the FWS. Input received indicates the best time for harvesting hay, especially the first cutting, is spring and early summer, impacting grassland bird and small mammal nesting. In addition, the general species composition and height of the vegetation in these hay fields do not provide suitable habitat for a number of species that would otherwise use these areas. However, no official decision has been made on this issue, so it remains as a possible continued activity under Alternative A. Alternative C (Proposed Action) no longer proposes the continuation of haying due to the reasons stated above.

Appendix C is the "Scoping Summary," which presents concerns and questions transcribed during the scoping meetings and individual comments received during the scoping comment period.

1.7.2 Public Comments on the Draft Environmental Assessment

The draft environmental assessment was available for public review on November 24, 2010. The comment period on the document closed on December 30, 2010.

1.7.3 Project Mailing List

A mailing list of 110 names was used to mail the postcards announcing the scoping meetings. Another postcard was mailed in November 2010 to announce the availability of the draft EA — there

were 246 names on the mailing list at that time. The mailing list will continue to be updated as necessary.

1.8 Permits, Licenses, and Other Consultation Requirements

A prescribed burn plan will be developed prior to implementation of each prescribed burn. All burn projects will comply with applicable regulations of the State of West Virginia Division of Forestry and U.S. Department of the Interior Fish and Wildlife Service and will be carried out in accordance with the requirements detailed in the Fire Management Plan for the NCTC.

As per regulations of the West Virginia Department of Agriculture, all pesticide application (such as herbicide, insecticide, fungicide, rodenticide, and so forth) at NCTC must be performed by a licensed pesticide applicator or by a registered technician under their supervision. Only products approved by the United States Environmental Protection Agency (EPA) will be used. The FWS requires that a Pesticide Use Proposal (see Appendix D) be submitted, reviewed, and approved at the NCTC and regional levels prior to treatment.

1.9 Related Plans

1.9.1 Deer Management Plan

The NCTC prepared its *White-tailed Deer Management Plan* in 2003 to regulate the growth of the white-tailed deer population on NCTC lands through implementation of an annual hunt based on deer population estimates acquired through spotlight surveys, previous hunting success on the property (for example, the number of does and bucks harvested), and success or effectiveness of previous hunting techniques (for example, shotgun versus bow).

1.9.2 Fire Management Plan and Prescribed Burn Plan

A prescribed burn plan will be prepared prior to the conduct of any prescribed burn, and all prescribed burns will be conducted in accordance with NCTC's Fire Management Plan. The NCTC Fire Management Plan is currently in its draft stage but will be finalized in 2011. It will detail the process for planning for and initiating a prescribed burn. An annual prescribed burn plan will begin with consultation between the Zone Fire Management Officer or designee and NCTC's Land Manager to formulate the annual prescribed burn plan. The completed prescribed burn plan will be submitted for a technical review process locally as coordinated by the Zone Fire Management Officer and then submitted to the Regional Fire Management Coordinator for further review. The NCTC Director will be responsible for final approval of the prescribed burn plan and will approve burn implementation using the Agency Administrator Go / No-Go Pre-ignition Approval Checklist.

Chapter 2. Proposed Action and Alternatives

2.1 Introduction

Three primary objectives are presented for management actions at the NCTC based on the purpose and need (refer to Chapter 1) for land management actions and FWS direction. The FWS is proposing actions at the NCTC to

1. protect and restore the ecological integrity of the native biological communities occurring at the NCTC
2. restore, maintain, and increase native habitat to support a diversity of wildlife occurring at the NCTC
3. protect NCTC assets (structures and natural resources) from a potentially devastating wildfire

2.2 Description of the Alternatives Considered in Detail

The CEQ regulations for implementing NEPA require federal agencies to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). The three alternatives analyzed in this EA are

Alternative A: No Action—Continue Current Level of Land Management

Alternative B: Cease All Land Management Activities

Alternative C: Proposed Action (Preferred Alternative)

2.2.1 Alternative A: No-Action Alternative—Continue Current Level of Land Management

This EA presents an analysis of a no-action alternative, which complies with CEQ regulations for implementing NEPA at 40 CFR 1502.14(d). The no-action alternative for this EA is described as continuation of the current level of management—this includes mowing, haying, and planting desired species; and chemical treatment of undesirable invasive exotic (nonnative) plant species. The Integrated Pest Management Plan (IPM plan) for the NCTC (USFWS 2008) provides a very detailed description of the current treatment methods and treatment objectives for management of invasive/exotic plants. The NCTC has been following the IPM plan's prioritization list for treating areas infested with invasive/exotic plants.

High-Priority Areas

- Roadside of Shepherd Grade Road and County Route 5/2
- Conservation Way and other paved roads within the NCTC
- Campus area around buildings

Medium-Priority Areas

- Farmstead area
- Ponds and wetlands

- Woodland areas on hillsides above Potomac River
- Trails
- Terrapin Neck Road

Low-Priority Areas

- Riverbank
- Other fields
- Other woodlands

The IPM plan also discusses "action thresholds," which are the population levels at which control is deemed to be appropriate. The unacceptable level of infestation in vegetation management in natural areas is typically the level that affects the objectives for the site. The action thresholds at the NCTC are dependent on the location (the priority areas listed above) and species involved. The action threshold for rare or new invasive species, where the objective is to prevent a plant from becoming established or producing seed, is one plant, regardless of location.

Sections 2.2.1.1, 2.2.1.2, and 2.2.1.3 below describe the vegetation management activities currently taking place at the NCTC and that will continue under Alternative A. The activities are discussed by vegetation type (that is, grassland areas, mixed-deciduous forest areas, and riparian/wetland areas).

2.2.1.1 Grassland Areas

There are approximately 229 acres of grasslands at the NCTC—Map A-4 shows the existing grassland areas (see Map A-5 for the proposed land cover at the NCTC). Of those 229 acres, 20 acres are slated to be reforested under existing plans, resulting in 209 acres to continue in grassland habitat.

The overall management objective for grassland habitat (other than areas planned for reforestation) is to restore the former agricultural fields to a native grassland biological community to provide optimum feeding, breeding, and wintering habitat for a diversity of grassland-dependent migratory birds, native pollinating invertebrates, and other native wildlife that are present. The management actions in grassland areas are scheduled seasonally and annually.

Treatment Objectives for Grassland Areas

a. Control or suppress 75 percent of nonnative plants (including forbs and woody plants), other than certain acceptable nonnative cool-season grasses, on the entire 229 acres of existing native and introduced grass fields over the next 15 years.

b. Complete the restoration of approximately 75 acres of old and agriculture fields to a mature plant community of native warm- and cool-season grasses within the next 15 years. Ideally, the native grassland plant community should be about 10 percent forbs (such as wild columbine, butterfly weed, wild blue indigo, wild bergamot, blazing star, black-eyed Susan, partridge pea, asters, and goldenrod); 65 percent warm-season grasses (such as big and little bluestem, switchgrass, Indian grass, broom sedge, and side-oats grama); and 25 percent cool-season grasses (such as Canada wild rye, purple-top, and red fescue). Grass and forbs will provide a diversity of height from approximately 6 inches to 6.5 feet.

c. Maintain breeding habitat (May 1 through July 31) for grassland species in at least 66 percent of total grassland habitat annually and maintain wintering habitat (November 1 through March 1) in at least 66 percent of total grassland habitat annually. Management strategies are scheduled seasonally and annually to meet this objective.

Continue Activities to Meet Treatment Objectives for Grassland Areas

Continue Activity 1—Mowing. Mowing is currently used to control woody vegetation and weeds. Mowing is also used to alter plant species composition. For example, mid-summer mowing of warm-season grasses tends to suppress them (and weeds) and maintains forbs and cool-season grasses. Mowing in late winter to early spring (while the grasses are dormant) is most beneficial to warm-season grasses. Mowing could be used on a rotating basis in all of the native warm- and cool-season grassland fields. Rotations could occur seasonally and annually on a two- to three-year basis, depending on the management objective.

Continue Activity 2—Haying. Haying, similar to mowing, is currently used to maintain the vigor of desired species and to control woody vegetation and weeds. Haying could occur on any of the grassland fields, and the fields may be rotated seasonally and annually to meet stated objectives. All haying activities occur according to a signed farming agreement

Continue Activity 3—Planting desired species. Seeds of locally native species of grasses and forbs are currently purchased and planted in the grassland fields. Planting is scheduled and conducted according to published planting recommendations to meet stated objectives. Planting is planned in cooperation with refuges in FWS Region 5 or other public agencies to take advantage of available staff and equipment.

Continue Activity 4—Chemically treating undesirable species. Some invasive native or exotic (nonnative) plant species require chemical treatment to suppress or control. The IPM plan approach is used to determine the various treatment methods (cultural, manual, mechanical, biological, and chemical) that are most suitable in various situations and on various species. The use of herbicides on grassland habitat is conducted according to the resource protection measures (typically referred to as "best management practices" when dealing with pesticides) listed below in Table 4 and in compliance with an approved Pesticide Use Proposal (see Appendix D) and all federal and state regulations. Some herbicide treatments are made by FWS personnel or private contractors. Some herbicide applications are conducted via a partnership with the National Park Service Exotic Plant Management Team. The park service provides a crew of trained and experienced personnel, lead by a crew leader who is a licensed applicator. Products currently or potentially used in grassland areas include Accord Concentrate, Milestone VM, Escort XP, Outrider, Garlon 3A, Garlon 4 Ultra, and Plateau. Aside from using the safest effective product available, the choice of product depends on factors such as the target plants, associated nontarget vegetation, and the type of area to be treated. Information on these products (and all pesticides *currently used or proposed*) is summarized in Appendix E, and detailed information can be found at the websites listed in that appendix.

2.2.1.2 Mixed-Deciduous Forest

There are approximately 284 acres of mixed-deciduous forest at the NCTC—Map A-4 shows those areas (see Map A-5 for the proposed land cover at the NCTC).

The overall management objectives for the forest areas are to protect or re-establish desired species, eradicate undesirable species, and protect forested areas from devastating wildfire.

Treatment Objectives for Mixed-Deciduous Forest Areas

a. Eliminate most invasive exotic plants on approximately 75 acres of the existing 284 acres of forest habitat to control or suppress invasive/exotic plant species over the next 15 years (5 acres forest per year). Removing invasive vegetation, particularly climbing vines, will also serve to reduce flammable ground and ladder fuels.

b. Continue the restoration of 55 acres of former agricultural fields to eventually establish a mature plant community of mixed-deciduous forest habitat. This would be done using natural regeneration and planting of approximately 3.6 acres of trees annually for the next 15 years. These areas are currently in grassland. Priority will be given to restoration of forest sites, which will help to fill forest gaps in the largest, most contiguous areas of existing forest cover.

c. Maintain the existing forest habitat by restricting any forest-clearing activities to only those deemed necessary for the safety of visitors, staff, and facilities; for educational purposes; and for reducing hazardous ground and ladder fuels in order to protect NCTC staff, visitors, structures, forest habitat, and NCTC neighbors from either human- or lightning-caused wildfires.

d. Provide habitat for cavity-nesting species by allowing snags to remain standing in areas where they do not pose a safety hazard to staff and visitors.

Continue Activities to Meet Treatment Objectives for Mixed-Deciduous Forest Areas

Continue Activity 1—Re-establishing desired species. Reforestation sites are currently evaluated to determine the locally native species best suited to the site conditions and surrounding habitat and the best methods for establishment and protection. Natural regeneration is used, in some cases, as either the sole method or in combination with planting. Only native tree and shrub species are planted. Seedlings and saplings used for planting are either grown at the NCTC or purchased from state or private nurseries. Planting activities are conducted by volunteers, staff, or contractors. Seedlings are typically planted by hand, frequently with mechanical assistance in preparing the site and digging the holes. Chemical vegetation control in site preparation and maintenance is used, as needed, during the establishment phase. Herbicide products are used to reduce vegetative competition from (mostly nonnative) grass, weeds, and vines on young seedlings. The typical products used in reforestation areas are Accord (or similar glyphosate products), Milestone, and Garlon 3A. See Appendix E for further information on these products.

Continue Activity 2—Chemically treating undesirable species. Some invasive native or exotic (nonnative) plant species in the forest areas may require chemical treatment to suppress or control. The application of pesticides in mixed-deciduous forests would be in the same manner as described in section 2.2.1.1 (“Continue Activity 4”) above for grassland areas. Typical products used

in the mixed-deciduous forests include Accord, Escort XP, Garlon 3A, Garlon 4 Ultra, and Sethoxydim E-Pro.

2.2.1.3 Riparian/Wetland Areas

There are approximately 15 acres of riparian/wetland areas at the NCTC—Map A-6 shows those areas. Three streams, nearly one mile of Potomac riverfront, five storm water management ponds and one spring-fed pond provide an important riparian and wetland habitat component to the NCTC landscape. Much of the biological diversity on the NCTC property can be found in these areas.

The overall management objective for riparian/wetland areas is to protect, maintain, and enhance the biological diversity of riparian/wetland areas.

Treatment Objectives for Riparian/Wetland Areas

a. Create and maintain a "natural" wetland habitat area in and around each of the storm water management ponds by increasing the native and desirable wetland plants in and near the ponds by 5 percent annually.

b. Maintain the riparian/wetland habitat at the NCTC by decreasing the invasive exotic plant species to less than 10 percent of the area in the next 15 years.

c. Maintain the existing stream banks and associated wetland areas by limiting use (no recreational use and only groups of 30 or less for educational purposes) and restricting construction and installation of any major structures (such as bridges, dams, and diversions) for the duration of this plan. An exception is occasional recreational fishing and walking on the bank of the Potomac River.

Continue Activities to Meet Treatment Objectives for Riparian/Wetland Areas

Continue Activity 1—Planting desired species. Plants are currently selected, purchased, and planted according to the objectives stated above. Planting activities are conducted with volunteers, staff, or contractors. This activity is closely coordinated with the FWS Division of Education and Outreach and their training plans and schedules.

Continue Activity 2—Chemically treating undesirable species. Some invasive/exotic plant species in riparian/wetland areas require chemical treatment to suppress or control. The IPM plan for the NCTC is used to determine the treatment methods (cultural, manual, mechanical, biological, and chemical) that are best suited to the various situations and on various species. Particular species occurring on the NCTC that may require chemical treatment are cattail, phragmites, Japanese hop, and Japanese knotweed, among others. The application of pesticides in riparian/wetland areas would be conducted in the same manner as described above in section 2.2.1.1 ("Continue Activity 4") for grassland areas. Typical products used in the riparian/wetland areas include Accord Concentrate and Garlon 3A, which are approved by the EPA for use in wetland and aquatic sites. Garlon 4 Ultra might be used on the stems of certain invasive trees and shrubs in dry sections of riparian areas.

2.2.2 Alternative B: Cease All Vegetation Management Actions

This alternative proposes that the NCTC would stop all land management actions—this includes mowing, haying, planting desired species, and chemically treating undesirable species.

2.2.3 Alternative C: Proposed Action (Preferred Alternative)

Alternative C proposes the continuation of all the activities presented under Alternative A, with the exception of haying, which would no longer occur under Alternative C. The proposed use of prescribed fire to manage vegetation and reduce fuel loads and actions to control "other pests" have been added to Alternative C. The management actions under Alternative C are discussed by habitat type.

2.2.3.1 Grassland Areas

The treatment objectives and treatment methods in grassland areas under Alternative C are the same as described for Alternative A, with the exception of the proposed prescribed fire to treat grassland areas and the discontinuance of haying.

Continued and Proposed Activities to Meet Treatment Objectives for Grassland Areas

Continue Activity 1—Mowing. Same as described for Alternative A.

Discontinue Activity 2—Discontinue haying and manage for wildlife habitat. All of the approximately 28 acres that have been used for harvesting hay would instead be managed for grassland habitat. This would provide better habitat for wildlife, especially small mammals and nesting birds. The primary nesting season for most grassland-nesting birds is not over until July 15 or later. This date is too late to make a first cutting of decent-quality hay and allows insufficient time for regrowth to make a second cutting, while still allowing enough regrowth to provide winter cover. Haymaking earlier than July 15 carries the risk of destroying nests and reducing available cover for vulnerable young wildlife. One of the existing cool-season grass hay fields (10 acres) would be planted to warm-season grass. The remaining 18 acres of cool-season hay fields would be managed to establish a more meadow-like habitat, with the existing (mostly nonnative) cool-season grasses gradually augmented (through natural regeneration and planting) with forbs and native cool-season and warm-season grasses.

Continue Activity 3—Planting desired species. Same as described for Alternative A, with an increased area to be reforested. A total of 68 acres of former agricultural fields would be restored to eventually form a mature plant community of mixed-deciduous forest habitat. This would be completed using natural regeneration and planting of approximately 4.5 acres of trees annually for the next 15 years. These areas are currently in grassland. Priority will be given to restoration of forest along riparian areas and on sites that will help to fill forest gaps in the largest, most contiguous areas of existing forest cover.

Continue Activity 4—Chemically treating undesirable species. Same as described for Alternative A.

Proposed Activity 5—Prescribed fire. Burning would be used to control weeds and woody vegetation, over time, to reduce litter build-up and fuel and stimulate grass and forb production. Spring burns tend to suppress cool-season grasses and promote warm-season grasses, while the opposite is true of mid- to late-summer burns. Prescribed fire on warm-season grasslands would typically be conducted once every three to four years on a particular area to achieve the most beneficial effects. While most burning would take place in warm-season grass fields, prescribed fires

may also occasionally be conducted on cool-season grasslands or areas with a mix of grass, forbs, and woody plants to keep them in grassland or prepare them for forest restoration. Small areas of woodland (such as fencerows, rock breaks, and woodland edges) that are located between or adjacent to fields being burned may also be included in burn areas. For purposes of this assessment, these have been considered part of the grassland rather than mixed-deciduous forest. A prescribed burn plan will be prepared prior to implementation of any prescribed fire, and all prescribed fires will be conducted in accordance with the Fire Management Plan for the NCTC and planned and conducted in cooperation with the Region 5 Refuge Fire Management Officer/Team and the local fire department. All local ordinances will be observed. Landowners and residents adjacent to the NCTC will be notified and, if feasible, be included in any prescribed fire planning. Section 2.5 lists the resource protection measures that will be followed for all treatments occurring on NCTC property.

2.2.3.2 Mixed-Deciduous Forest

Alternative C proposes to implement prescribed fire in the mix-deciduous forest areas (see Proposed Activity 3 below). Activities 1 and 2 are the same as described for mixed-deciduous forests under Alternative A.

Continued and Proposed Activities to Meet Treatment Objectives for Mixed-Deciduous Forest Areas

Continue Activity 1—Re-establish desired species. Same as described for Alternative A.

Continue Activity 2—Chemically treating undesirable species. Same as described for Alternative A.

Proposed Activity 3—Use prescribed fire to control or suppress invasive/exotic plant species and reduce ground and ladder fuels. Burning would be used to control weeds and undesirable woody vegetation, over time, and reduce litter buildup (ground fuels). Prescribed fire would be used, as needed, to reduce ladder fuels (vines, shrubs, or trees that connect fuels at the forest floor to the tree crowns). Any materials, such as branches and small woody vegetation, present after cutting ladders fuels would be removed if not needed for ground cover or would be piled and burned or chipped on-site. Fuel-reduction activities in the forest areas would be conducted on as as-needed basis if extended periods of low precipitation and drier-than-normal conditions are predicted. The objective of the fuel reduction activities is to affect wildfire behavior by creating conditions that will slow the rate of spread, severity, and intensity of the wildfire.

A burn plan would be prepared prior to implementation of any prescribed fire, and all prescribed fires would be conducted in accordance with the Fire Management Plan for the NCTC (USFWS 2010c) and planned and conducted in cooperation with the Region 5 Refuge Fire Management Officer/Team and the local fire department. All local ordinances would be observed. Landowners and residents adjacent to NCTC would be notified and, if feasible, be included in any prescribed fire planning. Section 2.5 below lists the resource protection measures (mitigation measures) that would be followed for all land management activities occurring on NCTC property.

2.2.3.3 Riparian/Wetland Areas

The treatment objectives and treatment methods in riparian/wetland areas under Alternative C are the same as described for Alternative A.

Continued Activities to Meet Treatment Objectives for Riparian/Wetland Areas

Continue Activity 1—Plant desired species. Same as described for Alternative A.

Continue Activity 2—Chemically treat undesirable species. Same as described for Alternative A.

2.2.3.4 Controlling Other Pests under Alternative C

Treatment Objectives for Controlling Insects, Diseases, Weeds, Rodents, Nonnative Animals, and Other Pests

The following are the overall treatment objectives for controlling other pests:

a. Protect human health and ensure the safety of workers, staff, and guests.

b. Protect habitat and other environmental factors in the process of conducting control measures.

c. Prevent unacceptable damage or impediment to forests, grasslands, and riparian areas; habitat restoration sites; landscaped areas; roads, sidewalks, trails, and fences; and buildings and other facilities.

Proposed Activities to Meet Treatment Objectives for Controlling Other Pests

Proposed Activity 1—Cultural control. Cultural control refers to management practices such as selection of plants used, removal or pruning of infested or diseased plants, vegetation management, and removal of nests, exclusion, or similar means. Problems caused by pests (such as Dutch elm disease, gypsy moth, German cockroach, mosquitoes, house mouse, Norway and black rats, poison ivy, dogwood discula, bark beetles, Japanese beetles, ants, fire blight, house fly, voles, ticks, hornets, wasps, yellow jackets, and brown marmorated stink bugs) may be prevented or limited through the use of cultural measures.

Proposed Activity 2 – Mechanical control. In some cases the pest organism can be collected, trapped, or otherwise physically removed or eliminated.

Proposed Activity 3—Chemically treating undesirable species. While some insects, plant diseases, ticks, weeds, rodents, and similar organisms may require chemical treatment to suppress or control in certain circumstances, most of the time no treatment will be needed or applied. The IPM plan will be used to determine the threshold and conditions that would trigger the particular methods (cultural, manual, mechanical, biological, and chemical) most suitable for use in various situations and on various species. The particular species occurring at the NCTC that may require chemical treatment are hemlock wooly adelgid, emerald ash borer, gypsy moth, German cockroach, mosquitoes, deer tick, house mouse, Norway and black rats, poison ivy, dogwood discula, sudden oak death, Ips beetles, Japanese beetles, and brown marmorated stink bugs, among others. The invasive exotic and native plants interfering with use and maintenance of landscape beds, sidewalks, trails, and fences may also be controlled in this manner.

The use of pesticides (such as insecticides, fungicides, herbicides, or similar chemicals) will be conducted according to the resource protection measures listed in Table 4. Pesticides will be used in compliance with all federal and state regulations, and they will be applied under the supervision of a

licensed pesticide applicator. Organic or natural products will also be a primary choice for controlling pests. Monitoring for the first appearance of pests can increase the likelihood that these types of products can be effective. Most fungicides only work as preventative treatments and need to be applied in anticipation of a fungal pathogen infestation. Products that have specific characteristics (such as low toxicity, rapid breakdown, specificity to the target pest, reduced impact on nontarget organisms [especially beneficial organisms]) would be the next choice. Broad-spectrum products would only be used as a last resort, if at all. Additionally, the method of application will take into account opportunities (such as bait stations, stem injection, and individual plant treatment) to limit exposure of people and the environment. Spray application in the campus zone would be conducted when the treatment area is vacant, such as nighttime, weekends, and holidays.

The following are examples of products that could be used (see Appendix E for more information):

- Herbicides — Accord Concentrate, Pendulum AquaCap, SureGuard
- Insecticides — horticultural oils, insecticidal soap, neem oil, Dipel (*Bacillus thuringiensis*), Pyrethrin, Conserve, Merit 2F, Talstar
- Fungicides — lime-sulfur, Daconil
- Rodenticides — Rodex Pelleted Bait, ERAZE Rodent Pellets

2.3 Alternatives Considered but Eliminated from Detailed Study

NEPA requires federal agencies to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). No suggestions for additional alternatives were received during the scoping process. One comment received during the scoping process suggested considering a new alternative with a combination of treatments. Creating an alternative that eliminated any of the current management activities or the proposed use of prescribed fire would not meet the objectives (purpose) and need for land management actions at the NCTC.

2.4 Summary Comparison of Alternatives

Tables 1, 2, and 3 provide a side-by-side comparison of the three alternatives. Table 1 compares the overall objectives for land management actions at the NCTC. Table 2 compares the treatment objects for the three vegetation types (grasslands, mixed-deciduous forests, and riparian/wetland areas). Table 3 provides the conclusions for effects that could result from implementing any of the alternatives.

The decision maker will use the proposal objectives, together with environmental effects, as evaluation criteria to select the alternative that best fulfills the proposal's objectives and satisfactorily meets environmental guidelines.

Table 1. Comparison of alternatives by overall management objective

Overall Project Objective	Alternative A (Continue Current Level of Management Actions)	Alternative B (Cease All Vegetation Management Actions)	Alternative C (Continue Current Management Actions and Add Prescribed Fire and Control of Other Pests)
Protect and restore the ecological integrity of the native biological communities occurring at the NCTC.	Would meet this objective to a large degree.	Would not meet this objective.	Would fully meet this objective.
Restore, maintain, and increase native habitat to support a diversity of wildlife occurring at the NCTC.	Would meet this objective to a large degree.	Would not meet this objective.	Would fully meet this objective. Adding prescribe fire provides an important tool for enhancing growth of native grasses and controlling invasive plants.
Protect NCTC assets (structures and natural resources) from a potentially devastating wildfire.	Would not fully meet this objective if fuel loads are not adequately reduced in the absence of prescribed fire. Would meet this objective where there are currently grassy areas/buffers (low potential for ignition) between structures and grasslands and forest areas.	Would meet objective to some degree where there are currently grassy areas/buffers (low potential for ignition) between structures and grasslands and forest areas. Would not meet this objective over time because fuel loads would not be monitored and reduced.	Would meet objective to a large degree where there are currently maintained grassy areas/buffers (low potential for ignition) between structures and grasslands and forest areas. Prescribed burning would reduce fuel loads in the grassland and mixed-deciduous forest areas and contribute to fully meeting this objective.

Table 2. Comparison of alternatives by treatment objective and vegetation type

Treatment Objectives by Vegetation Type	Alternative A	Alternative B	Alternative C
Grassland Areas			
a. Control or suppress 75 percent of invasive/exotic plant species (including forbs and woody plants), other than certain acceptable nonnative cool-season grasses, on the entire 229 acres of existing native and introduced grass fields and old fields over the next 15 years.	Could potentially meet this objective even in the absence of prescribe fire to assist with reaching the 75 percent goal.	Would not meet this objective.	Would fully meet this objective.
b. Complete the restoration of approximately 75 acres of old and agriculture fields to a mature plant community of native warm- and cool-season grasses within the next 15 years. Ideally, the native grassland plant community should be about • 10 percent forbs (such as wild columbine, butterfly weed, wild blue indigo, wild bergamot, blazing star, black-eyed Susan, partridge pea, asters, and goldenrod) • 65 percent warm-season grasses (such as big and little bluestem, switchgrass, Indian grass, broom sedge, and side-oats grama) • 25 percent cool-season grasses (such as Canada wild rye, purple-top, and red fescue). Grass and forbs will provide a diversity of height from approximately 6 inches to 6.5 feet.	Could potentially meet this objective in the absence of prescribe fire but could take longer than 15 years.	Would not meet this objective.	Would fully meet this objective.
c. Maintain breeding habitat (May 1 through July 31) for grassland species in at least 66 percent of total grassland habitat annually and maintain wintering habitat (November 1 through March 1) in at least 66 percent of total grassland habitat annually. Management strategies are scheduled seasonally and annually to meet this objective.	Would meet this objective to a large degree.	Would not meet this objective.	Would fully meet this objective.
Mixed-deciduous Forest Areas			
a. Eliminate most invasive exotic plants on approximately 75 acres of the existing 284 acres of forest habitat to control or suppress invasive/exotic plant species over the next 15 years (5 acres forest per year). Removing invasive vegetation, particularly climbing vines, will also serve to reduce flammable ground and ladder fuels.	Would fully meet this objective.	Would not meet this objective.	Would fully meet this objective.
b. Continue the restoration of 55 acres of former agricultural fields to eventually establish a mature plant community of mixed-deciduous forest habitat. This would be done using natural regeneration and planting of approximately 3.6 acres of trees annually for the next 15 years. These areas are currently in grassland. Priority will be given to restoration of forest sites, which will help to fill forest gaps in the largest, most contiguous areas of existing forest cover.	Would meet this objective to a large degree in the absence of prescribed fire.	Would not meet this objective.	Would fully meet this objective with inclusion of prescribed burning as site preparation on some sites.
c. Maintain the existing forest habitat by restricting any forest-clearing activities to only those deemed necessary for the safety of visitors, staff, and facilities; for educational purposes; and for reducing hazardous ground and ladder fuels in order to protect NCTC staff, visitors, structures, forest habitat, and NCTC neighbors from either human- or lightning-caused wildfires.	Would meet this objective to a large degree.	Would not meet this objective.	Would fully meet this objective.
d. Provide habitat for cavity-nesting species by allowing snags to remain standing in areas where they do not pose a safety hazard to staff and visitors.	Would fully meet this objective.	May meet this objective.	Would fully meet this objective.
Riparian/Wetland Areas			
a. Create and maintain a “natural” wetland habitat area in and around the storm water management ponds by increasing the native and desirable wetland plants in and near the ponds by 5 percent annually.	Would fully meet this objective.	Would not meet this objective.	Would fully meet this objective.

Table 2. Comparison of alternatives by treatment objective and vegetation type (continued)

Treatment Objectives by Vegetation Type	Alternative A	Alternative B	Alternative C
b. Maintain the riparian/wetland habitat on NCTC by decreasing the invasive/exotic plant species to less than 10 percent of the area in the next 15 years.	Would fully meet this objective.	Would not meet this objective.	Would fully meet this objective.
c. Maintain the existing stream banks and associated wetland areas by limiting use (no recreational use and groups of 30 or less for educational purposes) and restricting construction and installation of any major structures (such as bridges, dams, and diversions) for the duration of this plan. The only exception is occasional recreational fishing or walking on the bank of the Potomac River.	Would fully meet this objective.	Could meet this objective.	Would fully meet this objective.
Controlling Other Pests			
a. Protect human health and ensure the safety of workers, staff, and guests.	Would not meet this objective.	Would not meet this objective.	Would fully meet this objective.
b. Protect habitat and other environmental factors in the process of conducting control measures..	Would not meet this objective.	Would not meet this objective.	Would fully meet this objective.
c. Prevent unacceptable damage or impediment to forests, grasslands, and riparian areas; habitat restoration sites; landscaped areas; roads, sidewalks, trails, and fences; and buildings and other facilities.	Would not meet this objective.	Would not meet this objective.	Would fully meet this objective.

Table 3. Comparison of effects

	Alternative A	Alternative B	Alternative C
HABITAT AND WILDLIFE			
Grasslands	Long-term beneficial minor to major effects would persist as management actions continue to maintain and restore healthy, diverse habitat. If cool-season grasses were allowed to dominate an unmanaged stand, adverse effects could be minor to moderate in both the short and long term if habitat use, quality, and diversity were reduced. Mowing and haying could result in temporary negligible to minor adverse effects on wildlife species.	Choosing Alternative B would result in minor to moderate adverse effects in the short term, but as time goes by, effects would shift to moderate to major as native habitats are converted to monocultures of nonnative plants that may be unusable for many wildlife species.	Changing land use for the hay to less intensively managed cool and warm-season grasses would provide improved habitat conditions, especially for nesting wildlife.
	Continuing to plant desired species would produce both short- and long-term moderate to major beneficial effects on surrounding native vegetation and wildlife species that depend on native vegetation.		Same as Alternative A.
	The continued management of invasive plants would result in long-term minor to major beneficial effects on native vegetation. The herbicides pose either no risk or a slight risk to birds and no risk to mammals and insects; therefore, any adverse effects would be negligible or discountable. The implementation of the resource protection measures would mitigate any potential adverse effects to the negligible level.		Same as Alternative A.
	Prescribed fire not proposed.	Prescribed fire not proposed.	The effects of prescribed fire would be beneficial, in both the short and long term. Native grasses and forbs have greater seed production, germination, and establishment after a fire because burning allows plant nutrients to be returned to the soil and used again. There could be temporary negligible to minor adverse effects on small animal populations if they are unable to escape to safe areas during a prescribed burn.
	The effects of a wildfire could be both beneficial and adverse and range from minor to moderate in the short and long term, depending on variables that can affect fire behavior such as topography, temperature, humidity, wind speed, and structure of	Alternative B could slightly increase the fire risk due accumulations of ground fuels, such as litter, in the absence of any vegetation management actions.	Same as Alternative A.

Table 3. Comparison of effects (continued)

	Alternative A	Alternative B	Alternative C
	the plant community. The beneficial effects would be similar to those described for prescribed fire under Alternative C.		
	Managing grasslands in concert with controlling deer populations would result in long-term minor to major beneficial cumulative effects, commensurate with the level of management actions that are implemented in a given year and over time.	Continuing to monitor and control the white-tail deer population at the NCTC would benefit native grasslands by ensuring the deer do not over browse native vegetation that survive in the absence of any land management actions. Nonnative plant species would proliferate without any actions to minimize or eradicate them. Choosing Alternative B would result in minor to moderate adverse cumulative effects in the short term, but as time goes by, effects would shift to moderate to major as native habitats are converted to monocultures of nonnative plants that may be unusable for many wildlife species.	Same as Alternative A.
Mixed-Deciduous Forests	Continuing to plant desired species would not result in significant adverse effects on wildlife species, with adverse effects more likely to be negligible to minor and temporary during site preparation activities prior to planting. Long-term beneficial minor to major effects would persist as management actions continue to maintain and restore healthy, diverse habitat in the forest areas. Continuing to plant desired species would produce both short- and long-term beneficial effects on wildlife species that depend on native vegetation for breeding, nesting, roosting, and foraging.	Ceasing all land management actions at NCTC could have major long-term adverse effects as the native forest vegetation converts to nonnative invasive plant communities. Native plant populations would continue to shift toward a few species that are resistant to deer and can compete with exotic plants. Native wildlife adapted to native plants would be negatively affected.	Same as Alternative A.
	The continued use of herbicides would result in long-term minor to major beneficial effects on native vegetation because exotic invasive plants would be controlled or eradicated. Removing the invasive plants (either manually or chemically), particularly the hanging vines, would also reduce ground and ladder fuels. The herbicides pose either no risk or a slight risk to birds and no risk to mammals and insects; therefore, any adverse effects would be negligible or discountable. The implementation of the resource protection measures would mitigate any potential adverse effects to the negligible level.		Same as Alternative A.
	Prescribed fire not proposed.	Prescribed fire not proposed.	The effects of prescribed fire would be beneficial, in both the short and long term.

Table 3. Comparison of effects (continued)

	Alternative A	Alternative B	Alternative C
			Native forbs and other vegetation have greater seed production, germination, and establishment after a fire because burning allows plant nutrients to be returned to the soil and used again. Minor to moderate beneficial effects could be realized within a year or two following prescribed burns as native plants begin to thrive and spread. Complete eradication of nonnative vegetation in forest habitat would result in long-term moderate to major beneficial effects, but that may not be possible considering the level of human and financial resources that would be required. Adverse effects on fledglings and small mammals would be avoided by implementing prescribed burns before the breeding and nesting season. The use of prescribed fire to reduce fuels would help decrease fire risk and the potential for a devastating wildfire, resulting in beneficial effects from reduced fire danger.
	The effects of a wildfire could be both beneficial and adverse in the short and long term, depending on variables that can affect fire behavior such as topography, temperature, humidity, wind speed, and structure of the plant community and depending on what fuel reduction and other vegetation management actions occurred prior to the wildfire.	In the absence of actions to reduce fuel levels, the effects of a wildfire could be both beneficial or adverse in the short and long term, depending on the variables that can affect fire behavior such as topography, temperature, humidity, wind speed, and structure of the plant community.	The effects of a wildfire could be both beneficial or adverse in the short and long term, depending on the variables that can affect fire behavior such as topography, temperature, humidity, wind speed, and structure of the plant community and depending on what fuel reduction and other vegetation management actions occurred prior to the wildfire.
	Managing forest habitat in concert with controlling deer populations would result in long-term minor to major beneficial cumulative effects, commensurate with the level of management actions that are implemented in a given year and over time.	Choosing Alternative B would result in minor to moderate adverse cumulative effects in the short term, but as time goes by, effects would shift to moderate to major as native habitats are converted to monocultures of nonnative plants that may be unusable for many wildlife species.	Same at Alternative A.
Riparian/Wetlands	Alternatives A and C would produce short-term beneficial effects that may range from minor to moderate, depending on the amount of desired plants that can be reestablished or maintained each year, and moderate to major long-term beneficial effects if vegetation is continually managed.	Ceasing all land management actions at the NCTC could have major long-term adverse effects as the desirable riparian/wetland vegetation converts to nonnative invasive plant communities.	Same as Alternative A.

Table 3. Comparison of effects (continued)

	Alternative A	Alternative B	Alternative C
	Continuing to plant desired species would produce both short- and long-term beneficial effects on wildlife species that depend on native vegetation for breeding, nesting, roosting, and foraging. Adverse effects on wildlife from site preparation activities prior to planting would likely be minimal and temporary.	Ceasing all land management actions could lead to the potential loss of any wetland areas, resulting in local minor to major long-term adverse effects on wildlife if no management actions were taken to control invasive vegetation.	
	The continued use of herbicides would result in long-term minor to major beneficial effects on native vegetation because nonnative invasive plants would be controlled or eradicated. The herbicides pose either no risk or a slight risk to birds and no risk to mammals and insects; therefore, any adverse effects would be negligible or discountable. Potential adverse effects on freshwater invertebrates would be mitigated to negligible by the implementation of resource protection measures.		Same as Alternative A.
	Prescribed fire not proposed.	Prescribed fire not proposed.	Prescribed fire not proposed.
	A wildfire under Alternative A or C could result in negligible to minor adverse effects on vegetation and wildlife if vegetation management actions have reduced the amount of flammable vegetation, such as phragmites and cattails.	Adverse effects under Alternative B could increase to minor to major because no actions would have been taken to reduce the amount of combustible vegetation in the riparian/wetland areas.	See Alternative A.
	Managing wetland/riparian habitat in concert with controlling the deer population would result in long-term minor to major beneficial cumulative effects, commensurate with the level of management actions that are implemented in a given year and over time.	Continuing to monitor and control the white-tail deer population on NCTC will benefit riparian/wetland areas by ensuring the deer do not over browse native vegetation that survive in the absence of any land management actions. Nonnative plant species will proliferate without any actions to minimize or eradicate them. As native plant species are overtaken by invasive nonnative species, wildlife may begin to decline or migrate in search of suitable habitat off NCTC property. Choosing Alternative B would result in minor to moderate adverse cumulative effects in the short term, but as time goes by, effects would shift to moderate to major as native habitats are converted to monocultures of nonnative vegetation.	Same as Alternative A.
Controlling Pests	There would be negligible to minor adverse effects on native vegetation in the short term because no measures would be taken to monitor and protect	See Alternative A.	Monitoring and controlling the many types of pests would result in beneficial effects on human health, native vegetation, and wildlife.

Table 3. Comparison of effects (continued)

	Alternative A	Alternative B	Alternative C
	trees from insects and diseases. As time goes by, effects could shift from minor to major if insects and diseases begin killing large numbers of trees. Alternatives A and B might not protect NCTC staff and visitors from potential environmental and human health problems caused by pests and diseases they carry.		Invasive plants interfere with the use and maintenance of landscape beds, sidewalks, trails, and fences. The cultural and mechanical controls would not result in adverse effects on wildlife or native vegetation. Any potential adverse effects of using chemical controls would be mitigated through implementation of the IPM plan and resource protection measures.
	Alternatives A and B, in concert with continuing to monitor and control the white-tail deer population on NCTC, would not result in any adverse cumulative effects.	See Alternative A.	The implementation of actions to control pests throughout NCTC, in concert with controlling deer populations, would result in long-term minor to major beneficial cumulative effects, commensurate with the level of control measures that are implemented in a given year and over time.
SIGNIFICANT NATURAL FEATURES AND LISTED PLANT AND WILDLIFE SPECIES			
Limestone Cliffs	There would be no adverse effects on the limestone cliffs from the manual removal of invasive nonnative plants. There would also be no adverse effects from herbicides because they would be applied in a targeted manner, such as individual plant treatments and would avoid native flora (such as the rockcress). Highly selective products would be used and applied during periods when the nontarget plants are dormant.	No land management activities would occur in the vicinity of the limestone cliffs, so there would be no potential for adversely affecting wildlife or the spreading rockcress.	See Alternative A.
Caves	There would be no effects on the Shenandoah Valley cave amphipod, Madison cave isopod, Shenandoah Valley cave isopod, Blake millipede, and Indiana bat because resource protection measures would be implemented to buffer and protect the caves.	See Alternative A.	See Alternative A.
Mesic Forests	There would be no effects on the two orchid species because resource protection measures would be implemented to buffer and protect the plants.	No adverse effects.	Same as Alternative A.
	A wildfire in mesic (moderately moist) forest areas at NCTC would result in short-term adverse effects on vegetation that could range from negligible to minor, depending on variables that can affect fire behavior such as topography, temperature, humidity, wind	With no vegetation management activities, including fuel reduction, occurring under alternative B, a wildfire, under the right meteorological conditions, could potentially result in negligible to moderate adverse effects.	Same as Alternative A.

Table 3. Comparison of effects (continued)

	Alternative A	Alternative B	Alternative C
	speed, and structure of the plant community and depending on what vegetation management actions, including fuel reduction, were conducted prior to the wildfire.		
WATER RESOURCES			
Grasslands	There would be no adverse direct and indirect effects on water resources from haying, mowing, and planting desired species in grassland areas.	The lack of any management activities in grassland areas would not affect water resources at the NCTC.	Same as Alternative A, except haying would not occur under Alternative C.
	Herbicide use would not result in adverse effects on water resources.		Same as Alternative A.
	Prescribed fire not proposed.	Prescribed fire not proposed.	There would be no adverse effects on water resources from prescribed fire in grassland areas.
	If a wildfire were to occur in grassland areas, adverse effects would be non-existent to negligible and temporary on water resources. The level of effects from a wildfire would depend on variables that can affect fire behavior such as topography, temperature, humidity, wind speed, and structure and density of the plant community and on what fuel reduction actions were conducted prior to the wildfire.	If a wildfire were to occur in grassland areas, even in the absence of vegetation management actions under Alternative B, adverse effects would be non-existent to minor and temporary on water resources. The level of effects from a wildfire would depend on variables that can affect fire behavior such as topography, temperature, humidity, wind speed, and structure and density of the plant community.	Same as Alternative A.
	Continuing to monitor and control the deer population at the NCTC, in combination with management actions in grassland areas, would not produce any cumulative effects on water resources.	The lack of any management activities in grassland areas, in combination with continuing efforts to monitor and control the deer population at the NCTC, would not produce any cumulative effects	Same as Alternative A.
Mixed-Deciduous Forests	There would be no adverse effects on water resources from continuing to plant desired species and chemically treating undesirable species under Alternatives A and C. These actions would not contribute sediments to any water resources at the NCTC and would not affect pond or stream temperatures and pH.	The lack of any management activities in mixed-deciduous forest areas would not affect water resources at the NCTC, except as described for wildfire.	Same as Alternative A.
	Prescribed fire not proposed.	Prescribed fire not proposed.	There would be either no or negligible temporary adverse effects on water resources from prescribed fire in the mixed-deciduous forests because there would be little chance for soil erosion and sediment delivery to

Table 3. Comparison of effects (continued)

	Alternative A	Alternative B	Alternative C
			ponds or streams.
	Adverse effects on water resources from a wildfire could range from negligible to moderate and temporary if the wildfire contributed to sediment delivery to ponds or streams at the NCTC. There could be temporary negligible to minor adverse effects on the Potomac River if the sediments reached the river. The variables that would determine the level of adverse effects include weather conditions and moisture content of vegetation at the time of the wildfire, management actions taken to reduce fuel levels, land slope , proximity to waterways, and size of the fire.	Even under Alternative B without any vegetation management actions occurring, adverse effects on water resource from a wildfire would be temporary and range from negligible to minor.	See Alternative A.
	Continuing to monitor and control the deer population at the NCTC, in combination with management actions in mixed-deciduous forest areas, would not produce any adverse cumulative effects on water resources.	Alternative B, in combination with continuing efforts to monitor and control the deer population at the NCTC, would not produce any adverse cumulative effects on water resources.	Same as Alternative A.
Riparian/Wetlands	There would be no adverse effects on water resources from planting desired species in riparian/wetland areas.	The increase in invasive vegetation in the ponds and wetland areas could lead to lower water levels, which would directly affect water temperature and pH. The lack of any management activities in riparian/wetland areas would have the greatest adverse effect on wildlife species that inhabit these important areas.	Same as Alternative A.
	There would be no adverse effects on water resources from using herbicides in riparian/wetland areas.		Same as Alternative A.
	Prescribed fire not proposed.	Prescribed fire not proposed.	Prescribed fire not proposed.
	Adverse effects on water resources from a wildfire could range from negligible to moderate and temporary if the wildfire contributed to sediment delivery to ponds or streams at the NCTC. There could be temporary negligible to minor adverse effects on the Potomac River if the sediments reached the river. The variables that would determine the level of adverse effects include weather conditions and moisture content of vegetation at the time of the wildfire and particularly what vegetation management actions, including fuel reduction, had been taken to reduce the density of vegetation, particularly phragmites and cattails, which are very combustible.	Even under Alternative B without any vegetation management actions occurring, adverse effects on water resource from a wildfire would be temporary and range from negligible to moderate.	See Alternative A.

Table 3. Comparison of effects (continued)

	Alternative A	Alternative B	Alternative C
	Continuing to monitor and control the deer population at the NCTC, in combination with management actions in riparian/wetland areas, would not produce any adverse cumulative effects on water resources.	The lack of any management activities in riparian/wetland areas, in combination with continuing efforts to monitor and control the deer population at the NCTC, would not produce any adverse cumulative effects on water resources.	Same as Alternative A.
SOILS			
Grasslands	There could be negligible adverse effects on soil cover and organic matter from haying, mowing, and planting desired species in grassland areas, and ~~no~~ little risk of detrimental compaction or soil displacement.	The lack of management activities in grassland areas would not lead to adverse effects on soil cover and organic matter nor would it lead to detrimental compaction or soil displacement.	Same as Alternative A, with less likelihood of adverse effect due to discontinuation of haying.
	Herbicide use would not result in adverse effects on soils.		Same as Alternative A.
	Prescribed fire not proposed.	Prescribed fire not proposed.	Beneficial effects on soils would result from prescribed fire because fire kills woody plants, allowing sunlight to reach the soil and changing the soil pH and nutrient availability. Native grasses and forbs have greater seed production, germination, and establishment after a fire because burning allows plant nutrients to be returned to the soil and used again. There could be some potential for loss of soil cover and organic matter, but no risk of detrimental compaction or soil displacement. The resources protection measures listed in Table 4 (Chapter 2) would be implemented to minimize or eliminate adverse effects on soils.
	The potential for a wildfire to occur under average meteorological conditions in northeastern West Virginia is low to moderate. A wildfire in a grass field would not result in major adverse effects on soil cover and organic matter, nor would a wildfire cause detrimental compaction or soil displacement. As with prescribed fire under Alternative C, a wildfire could result in beneficial effects on soils because fire kills woody plants, allowing sunlight to reach the soil and changing the soil pH and nutrient availability. Native grasses and forbs have greater seed production, germination, and establishment after a fire because burning allows plant nutrients to be returned to the soil and used again.	Even in the absence of any vegetation management actions under Alternative B, a wildfire in a grass field would not result in major adverse effects on soil cover and organic matter nor would a wildfire cause detrimental compaction or soil displacement.	Same as Alternative A.

Table 3. Comparison of effects (continued)

	Alternative A	Alternative B	Alternative C
	The lack of any management activities in grassland areas, in combination with continuing efforts to monitor and control the deer population at the NCTC, would not produce any cumulative effects on soils.	Same as Alternative A.	Continuing to monitor and control the deer population at the NCTC, in combination with management actions in grassland areas, would not produce any cumulative effects on soils.
Mixed-Deciduous Forests	Continuing to plant desired species under Alternatives A and C would not result in any disturbances that would adversely affect soil cover and organic matter or cause detrimental compaction or soil displacement.	The lack of management activities in mixed-deciduous forest areas would not lead to adverse effects on soil cover and organic matter nor would it lead to detrimental compaction or soil displacement.	Same as Alternative A.
	Herbicide use would not result in adverse effects on soils.		Herbicide use would not result in adverse effects on soils.
	Prescribed fire not proposed.	Prescribed fire not proposed.	Beneficial effects on soils would result from prescribed fire because fire kills woody plants, allowing sunlight to reach the soil and changing the soil pH and nutrient availability. Native plants have greater seed production, germination, and establishment after a fire because burning allows plant nutrients to be returned to the soil and used again. There would be some potential for loss of soil cover and organic matter, but no risk of detrimental compaction or soil displacement.
	As with prescribed fire under Alternative C, a wildfire could result in beneficial effects on soils because fire kills woody plants, allowing sunlight to reach the soil and changing the soil pH and nutrient availability. Native plants have greater seed production, germination, and establishment after a fire because burning allows plant nutrients to be returned to the soil and used again. A wildfire in a forest area would not result in major adverse effects on soils, although there would be some potential for loss of soil cover and organic matter, depending on the severity of the fire, but no risk of detrimental compaction or soil displacement. However, extreme fire can cause accelerated erosion and require mitigation measures such as rapid revegetation (NIFC 2010).	A wildfire could result in the same beneficial effects on soils as described for Alternative A. Adverse effects on soils would be as discussed for Alternative A, even in the absence of any vegetation management actions under Alternative B.	Same as Alternative A.
	Continuing to monitor and control the deer population at the NCTC, in combination with	The lack of any management activities in mixed-deciduous forest areas, in combination with	Same as Alternative A.

Table 3. Comparison of effects (continued)

	Alternative A	Alternative B	Alternative C
	management actions in mixed-deciduous forest areas, would not produce any cumulative effects on soils.	continuing efforts to monitor and control the deer population at the NCTC, would not produce any cumulative effects on soils.	
Riparian/Wetlands	There would be no short- or long-term adverse effects on soils from planting desired species in riparian/wetland areas.	The lack of management activities in riparian/wetland areas would not lead to adverse effects on soil cover and organic matter nor would it lead to detrimental compaction or soil displacement.	Same as Alternative A.
	There would be no short- or long-term adverse effects on soils from using herbicides in riparian/wetland areas.		Same as Alternative A.
	Prescribed fire not proposed.	Prescribed fire not proposed.	Prescribed fire not proposed.
	A wildfire in a riparian/wetland area would not result in major adverse effects on soils, although there would be some potential for loss of soil cover and organic matter, depending on the severity of the fire, but no risk of detrimental compaction or soil displacement. However, extreme fire can cause accelerated erosion and require mitigation measures such as rapid revegetation (NIFC 2010).	See Alternative A.	See Alternative A.
	Continuing to monitor and control the deer population at the NCTC, in combination with management actions in riparian/wetland areas, would not produce any adverse cumulative effects on soils.	Alternative B, in combination with continuing efforts to monitor and control the deer population at the NCTC, would not produce any adverse cumulative effects on soils.	Same as Alternative A.
SOCIAL VALUES			
Human Health and Safety	There would be no short- or long-term adverse effects on human health and safety from using herbicides to treat invasive vegetation and pesticides to control other pests. Resource protection measures will be implemented to ensure that people, especially children, would not be adversely affected by pesticide applications.	The lack of treatments to manage invasive plant species would not lead to adverse effects on human health and safety; however, people would be adversely affected by other pests, such as insects and rodents.	See Alternative A.
	Continuing to monitor and control the deer population at the NCTC, in combination with land management actions, would not produce any adverse cumulative effects on human health and safety.	Continuing to monitor and control the deer population at the NCTC, in the absence of any land management actions, would not produce any adverse cumulative effects on human health and safety.	See Alternative A.
	Prescribed fire not proposed.	Prescribed fire not proposed.	Adverse effects from smoke would be temporary and negligible to minor, occurring only during prescribed burn. There would be no short- or long-term adverse effects on human health and safety from the burns.
	Human safety is the first priority during a wildfire, and evacuation of staff and visitors would occur if	Same as Alternative A.	Same as Alternative A.

Table 3. Comparison of effects (continued)

	Alternative A	Alternative B	Alternative C
	wildfire threatened occupied structures. Any adverse effects from smoke would be temporary and negligible to minor. There would be no long-term adverse effects on human health and safety from a wildfire. Creating and maintaining defensible space around structures would promote public safety. A wildfire would have a temporary but potentially minor to major increase in emissions and degradation of air quality, depending on vegetative and meteorological conditions at the time of the fire. A single event, however, would not affect the county's attainment status. There could be an indirect beneficial effect if prescribed fire is used to reduce fuel loads because emissions from any future wildfires would be reduced.		
Significant Values	There would be no short- or long-term adverse effects on significant values from using herbicides, but beneficial effects would be realized by protecting significant values from invasive vegetation.	Short- and long-term adverse effects on significant values could result from uncontrolled growth of invasive plants.	Same as Alternative A.
	Prescribed fire not proposed.	Prescribed fire not proposed.	There would be no short- or long-term adverse effects on significant values from conducting prescribed burns, and implementation of the resource protection measures during the burns will serve to protect cultural resources and structures.
	The creation and maintenance of defensible spaces would ensure continued protection of NCTC cultural resources and structures—a beneficial effect. Any adverse effects on significant values would be nonexistent to negligible and temporary, primarily from smoke.	Alternative B would not provide the same amount of protection because not all defensible spaces would be maintained. Adverse effects on significant values could range from negligible to major, and potentially permanent if cultural resources are destroyed.	Same as Alternative A.
	Alternative A, in combination with continuing efforts to monitor and control the deer population at the NCTC, would not produce any adverse cumulative effects on significant values	Alternative B, in combination with continuing efforts to monitor and control the deer population at the NCTC, would not produce any adverse cumulative effects on significant values.	Same as Alternative A.
Environmental Justice	There would be no disproportionately high or adverse human health or environmental effects on minority populations and low-income populations.	Same as Alternative A.	Same as Alternative A.

2.5 Resource Protection Measures

Resource protection measures (also known as mitigation measures) are designed to avoid or substantially reduce a project's adverse environmental effects. The resource protection measures presented in Table 4 below are incorporated into Alternatives A and C.

Table 4. Resource protection measures

Resource	Resource Protection Measure
Human Health and Safety	
Pesticide Use, Public	• Measures will be taken to avoid exposure to guests and staff, which will include such practices as prior notification of planned outdoor activities or planned pesticide use, avoidance of occupied areas, signage and/or direct observation of the site until the re-entry interval has passed, or application during times when the NCTC is closed, as appropriate. • The location and weather conditions for the pesticide application will comply with the product label. • Off-site drift will be avoided by using such practices as limiting allowable wind speed to 10 miles per hour (mph) or less, using nozzles that create large droplet size or methods of application that are unlikely to drift.
Pesticide Use, Applicator	• Personnel using pesticides will have training in appropriate procedures for safe application, first aid, and spill cleanup. • Pesticide applicators will use personal protective equipment (PPE) as required by the product label. Standard PPE used for most pesticide applications includes long-sleeve shirt, long pants, shoes, and socks. Other PPE sometimes required or recommended include eye protection and chemical-resistant gloves. Other measures sometimes required or appropriate are rubber boots or protective aprons or coveralls. No pesticide products to be used require the use of a respirator. All types of PPE, including those not required, will be available to the applicator to use at his or her discretion. • Personnel who are mixing, loading, and applying pesticides will have appropriate medical monitoring, as specified in FWS policy.
Prescribed Fire	• The prescribed burn plans, which will include smoke management plans, will be prepared by the Land Manager and Region 5 fire staff prior to implementing prescribed burns. • Prescribed burns will comply with applicable regulations of the State of West Virginia Division of Forestry and U.S. Department of the Interior Fish and Wildlife Service and will be carried out in accordance with the requirements detailed in the Fire Management Plan for the NCTC. • The staff at the NCTC, particularly at the Children's Center, will be advised when a prescribed burn will be conducted so children can temporarily remain indoors during that short time period of the burn. • Local law enforcement will be requested to hold up traffic for a short period of time if there is potential for the prevailing wind to carry smoke toward Shepherd Grade Road or Terrapin Neck Road in a way that would cause temporary visibility hazards from smoke. • Warning signs or road guards will be posted to advise motorists of a prescribed burn in progress, especially if smoke could reduce visibility. • As needed, NCTC roads adjacent to burn units will temporarily be closed. • No ground disturbance will occur along the Potomac River floodplain and its steep slopes. • Ample notification will be given to landowners in the adjacent *Communities at Risk*—Leisure Acres and North Terrapin Neck. Notices may also be posted to inform other adjacent landowners of prescribed burns. • Press releases will be provided to the local media to inform the public in advance of a prescribed burn. • The Jefferson County Emergency Communications Center, the West Virginia Division of Forestry, the Shepherdstown Volunteer Fire Department, and Jefferson County Sheriff's office will be notified prior to prescribed burns. • Prescribed burns will not be started until all contingency forces are confirmed to be on-site or in standby status, as specified in the prescribed burn plan.

Table 4. Resource protection measures (continued)

Resource	Resource Protection Measure
Vegetation and Wildlife	
Bald Eagle	• Follow the applicable "Bald Eagle Management Guidelines and Conservation Measures" available at http://www.fws.gov/midwest/eagle/guidelines/bgepa.html. • No prescribed burning or heavy smoke will be allowed within 330 feet of bald eagle nest sites from December 1 through July 1. • During wildfire suppression, keep equipment, aircraft, and personnel away from the nest site during active periods, if possible.
Indiana Bat	• Cave habitat will be protected by maintaining a minimum 75 foot buffer, which could exclude herbicide or other pesticide application, prescribed burning, or any activity that would increase water, sediment, or debris entering the cave. • Indiana bat habitat should be protected by maintaining as many trees as practical that are snags, hollow, or that have features such as cracks or shaggy bark. If such a tree is to be cut it is preferable to do so in late fall or winter when bats are done rearing young (USFWS, B. Douglas, email to P. Pannill, January 20, 2011).
Other Wildlife	• Mowing and haying will not occur until July 15 to provide protection for broods and fledglings. • In order to protect freshwater invertebrates and fish, Garlon 4 Ultra or similar products will not be used where drift or runoff could reach ponds, streams, or the Potomac River. • Prescribed burns will not occur from April 15 to July 15 in order to protect migratory birds and small mammals. • All planted trees protected with tree shelters (to avoid deer herbivory) will be capped and/or screened to prevent bird entrapment until seedlings have reached the top of the shelter. Capped tree guards will be inspected and replaced at least once per year in the late winter or early spring to ensure tree shelters do not act as nesting attractants and therefore cause entrapment.
Native, Sensitive, and Rare Plants	
Pre-treatment	• Create herbicide-free buffers around nontarget, sensitive, and rare plants and sensitive areas. • Shield nontarget, sensitive, and rare plants with suitable material, such as a 5-gallon bucket or tree shelter, if practical.
Application	• When possible apply selective products or apply when sensitive plants are dormant. • Use the lowest effective application rate. • Apply herbicide by foliar spray when wind speed is less than 10 mph.
Post-treatment	• Monitor before, during, and after herbicide application to assess effects on target species, nontarget organisms, and the environment.
Spring Coralroot and October ladies'-Tresses	• Prior to working in the mesic limestone forest areas, employees will be trained to recognize and avoid the two rare plants and the habitat in which they are commonly found. In the more pristine areas and those that harbor rare plants, no trails should be built, recreational activity discouraged, and invasive plant control should be done with care, using manual means as much as possible or chemical methods with selective products or at times the key plants are dormant.
Invasive/Exotic Plants	
Prevention	• Vehicles will minimize driving in areas infested with invasive/exotic plants at a time when movement of seeds is likely, and when this is not possible, vehicles and equipment will be cleaned after leaving an infested area. Vehicles and equipment will be considered clean when a visual inspection does not disclose seeds, soil, vegetative matter, and other debris that could contain or hold seeds. • A designated location will be identified for the cleaning described above. This will be in a spot not conducive to exotic weed establishment and will be monitored for incipient weed populations.

Table 4. Resource protection measures (continued)

Resource	Resource Protection Measure
Control and Monitor	• Conduct post-treatment surveys in mowed, hayed, sprayed, and burned areas and use site-specific evaluations to determine appropriate treatment to control any invasive/exotic plants that are located. Continue to monitor mowed, hayed, sprayed, and burned areas for invasive/exotic plants. • New noxious weed populations, resulting from project implementation, will be treated and monitored.
Cave Wildlife	
Prevention	• Cave wildlife will be protected by maintaining a minimum 75 foot buffer, which could exclude herbicide or other pesticide application, prescribed burning, or any activity that would increase water, sediment, or debris entering the cave (USFWS, B. Douglas, email to P. Pannill, January 20, 2011).
Water Resources	
	• Minimize soil disturbance and thus potential for sediment delivery to streams and ponds during prescribed burning by using previously prepared vegetated firebreaks or existing barriers such as roads and trails, even if this results in a slight increase in burned area. • Prevent or minimize soil erosion and thus potential for sediment delivery to streams and ponds by retaining a high proportion (80 percent or more) of surface cover in vegetation, litter (dead leaves, grass, and other dead plant parts), and fibrous root systems.
Soils	
	• Prevent or minimize soil erosion by retaining a high proportion (80 percent or more) of surface cover in vegetation, litter (dead leaves, grass, and other dead plant parts), and fibrous root systems. • Areas treated by herbicide application with the products and circumstances under consideration, retain litter cover and typically re-vegetate quickly. • Minimize soil disturbance for fire lines in prescribed burning and for wildfires by using previously prepared vegetated firebreaks or existing barriers such as roads, trails, and streams, even if this results in a slight increase in burned area. • Prevent or minimize soil compaction by limiting vehicles to designated roads and trails and avoid use of heavy equipment when other methods are practical.
Cultural Resources	
	• Cultural resource sites will only be treated, as necessary, if they are at risk of infestation by invasive/exotic plants and if fuel loads on the site would put the resource at increased risk of damage or destruction in the event of a wildfire. • The Land Manager will be contacted immediately if previously unrecorded cultural resources are discovered during any vegetation treatments. The cultural resources will be recorded, delineated, and protected.
Controlling Other Pests	
	• Feeding of animals on NCTC property is not allowed—this includes domestic, feral, and wild animals. NCTC staff and guests will be informed of this policy. • Pest control activities will be conducted according to IPM principles. • Periodic inspections, monthly during the growing season, will be made of trees, other plants, and the general landscape area near the buildings. The presence of insects, disease, weeds, or other pest problems will be reported to the Land Manager. Treatment will be applied when pests meet the pre-determined treatment threshold. • The use of cultural control and biological control measures will be considered first. • If pesticide treatment is appropriate, resource protection measures will be taken as described under “Human Health and Safety” at the beginning of this table. • When practical, “natural” or “organic” pesticide treatments will be used. Examples of these are insecticidal soap, horticultural oil, *Bacillus thuringiensis*, and pyrethrins. • Rodenticides will be used in tamper-resistant bait stations located to minimize potential direct or secondary consumption by nontarget species. • If pesticide use is needed, the least toxic effective product will be used. • All federal and state wildlife laws will be followed.

Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction

This chapter summarizes the biological, physical, and social environments at the NCTC and both the beneficial and adverse effects on these environments that could result from Alternative A: No Action—Continue Current Level of Land Management; Alternative B: Cease All Land Management Activities; or Alternative C: Proposed Action (Preferred Alternative).

This chapter presents the laws and policies relevant to each resource topic and the methods used to analyze existing conditions and potential effects.

3.1.1 Analysis Period (Duration of Effects)

Each resource section in this chapter defines the analysis period used for evaluating effects on that specific resource.

3.1.2 Definitions for Evaluating Effects

The "Environmental Consequences" section for each resource describes the types of effects that would result from taking no action or implementing either action alternative; those effects are described according to the definitions in section 3.1.2.1.

3.1.2.1 Types of Effects

- **Beneficial effects** are those that would result in a positive change in the condition or nature of the resource, usually with respect to a standard or objective. It is a change that would move a resource toward its desired condition.
- **Adverse effects** are those that would result in a negative change in the condition or nature of the resource, usually with respect to a standard or objective. It is a change that would move a resource away from its desired condition.
- **Direct effects** are caused by the action and would occur at the same place and time as the action.
- **Indirect effects** are also caused by the action, would occur later in time, and are further removed in distance but are still reasonably foreseeable; or the response of the target resource is triggered by the reaction of another resource to the proposed action.
- **Cumulative effects** are those that would result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.

3.1.2.2 Intensity of Effects

"Intensity" refers to the severity of effects or the degree to which an action may adversely or beneficially affect a resource. The intensity definitions are presented in each resource section because they vary by resource topic.

3.1.3 Council on Environmental Quality Guidance on Cumulative Effects Analysis

The CEQ Regulations for Implementing the Procedural Provisions of NEPA at 40 CFR 1508.7 define cumulative effects (impacts) as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions."

The Council on Environmental Quality revised its guidance (memorandum prepared by James L. Connaughton, Chairman, White House Council on Environmental Quality, June 24, 2005) on the extent to which agencies of the federal government are required to analyze the environmental effects of past actions when they describe the cumulative environmental effects of a proposed action in accordance with section 102 of NEPA (42 United States Code [USC] 4332 and the CEQ Regulations for Implementing the Procedural Provisions of NEPA at 40 CFR 1500-1508. CEQ's interpretation of NEPA is entitled to deference. *Andrus* v. *Sierra Club*, 442 U.S. 347, 358 (1979)).

The following is excerpted from that June 24, 2005, memorandum:

> *The environmental analysis required under NEPA is forward-looking, in that it focuses on the potential impacts of the proposed action that an agency is considering.*

The Council on Environmental Quality interprets NEPA and CEQ's NEPA regulations on cumulative effects as requiring analysis and a concise description of the identifiable present effects of past actions to the extent that they are relevant and useful in analyzing whether the reasonably foreseeable effects of the agency proposal for action and its alternatives may have a continuing, additive, and significant relationship to those effects. In determining what information is necessary for a cumulative effects analysis, agencies should use scoping to focus on the extent to which information is "relevant to reasonably foreseeable significant adverse impacts," is "essential to a reasoned choice among alternatives," and can be obtained without exorbitant cost (40 CFR 1502.22).

3.1.4 Past, Present, and Reasonably Foreseeable Future Actions on or in the Vicinity of the NCTC

The only action considered for the purpose of assessing cumulative effects is ongoing management to monitor and control the white tail deer population at the NCTC. There are no past actions or known reasonably foreseeable future actions that would contribute to cumulative effects.

3.2 Habitat and Wildlife

3.2.1 Introduction

This section describes the vegetation and terrestrial and aquatic wildlife known to be present at the NCTC. This section also describes the effects from Alternative A (Continue Current Level of Land Management), Alternative B (Cease All Land Management Actions), or Alternative C (Proposed Action).

3.2.2 Regulatory Framework

3.2.2.1 Endangered Species Act of 1973

The *Endangered Species Act* (ESA) gives the U.S. Secretary of the Interior and the U.S. Secretary of Commerce joint authority to list a species as threatened or endangered (16 USC 1533[c]). Pursuant to the requirements of ESA section 7, an agency reviewing a proposed project within its jurisdiction must determine whether any federally listed threatened or endangered species may be present in a project area and determine whether the proposed project will have a likely effect on listed species.

3.2.2.2 Migratory Bird Treaty Act (16 USC Sec. 703, Supp. I, 1989)

A migratory bird is any species or family of birds that live, reproduce, or migrate within or across international borders at some point during their annual life cycle. This law implements the treaties that the United States has signed with a number of countries to protect birds that migrate across United States borders. The law makes it illegal to take, possess, or sell protected species. The *Migratory Bird Treaty Act* currently protects 836 species of migratory birds (see the following website for detailed information: http://www.fws.gov/laws/lawsdigest/migtrea.html).

3.2.2.3 Neotropical Migratory Bird Conservation Act (16 USC 6101-6102)

The Congress of the United States passed the *Neotropical Migratory Bird Conservation Act* on July 20, 2000. The purposes of the act are to (1) perpetuate healthy populations of Neotropical migratory birds; (2) assist in the conservation of Neotropical migratory birds by supporting conservation initiatives in the United States, Canada, Latin America, and the Caribbean; and (3) provide financial resources and foster international cooperation for those initiatives. The FWS Division of Bird Habitat Conservation is responsible for managing the grants program that implements the act (see the following website for detailed information: (http://www.fws.gov/birdhabitat/Grants/NMBCA/ACT.shtm).

3.2.2.4 Bald and Golden Eagle Protection Act (16 USC 668-668d, 54 Stat. 250)

This law provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession, and commerce of such birds. The 1972 amendments increased penalties for violating provisions of the act or its regulations and strengthened other enforcement measures (see the following website for detailed

information: http://www.fws.gov/midwest/eagle/guidelines/bgepa.html). There is currently one active eagle nest at the NCTC; that nest is in the vicinity of the barn north of the Hendrix farmstead.

3.2.3 Methodology

3.2.3.1 Analysis Approach and Assumptions

Threatened and Endangered Species

The Natural Heritage Program of the West Virginia Division of Natural Resources has published guidelines for conserving significant natural features in Jefferson County. Those guidelines list rare, threatened, and endangered species known to occur in the county, many of which are species of concern in the state. However, because West Virginia has no official state regulations protecting sensitive species, the only species afforded protection in the state are those that are federally listed as threatened or endangered under the *Endangered Species Act*. There are two federally listed wildlife species with potential habitat present on the NCTC property. Those two species (Madison cave isopod and Indiana bat) are discussed in Chapter 3 in section "3.3.3.4 Cave Habitat: Existing Conditions."

Priority and Focal Wildlife Species and Habitat Requirements

Effective and efficient management of natural resources on FWS lands means knowing the species and habitats most in need of conservation efforts. The FWS's approach to selecting priority species was to first assemble the most recent version of all landscape-scale conservation plans because these plans have accepted and rigorous prioritization schemes. The NCTC falls on the border of two different Partners in Flight physiographic areas: the Mid-Atlantic Piedmont Area #10 and the Mid-Atlantic Ridge and Valley Area #12. The priority species were identified by comparing lists of species and habitats identified in these plans and considering those species listed under the *Endangered Species Act*, as well as the West Virginia Sensitive Species list. The FWS considered the historic, current, and potential of the NCTC to contribute to the conservation of the species and habitat. Finally, a separate plan entitled "Guidelines for the Conservation of Significant Natural Features in Jefferson County, West Virginia," was reviewed, and any relevant species and habitats were included in the list of resources of concern.

The underlying ecological principle to prioritization is that a focused management action on priority species also benefits other species of wildlife. In other words, focused action on *priority* species will extend benefits to most species using wildlife habitat on NCTC land. *Focal* species represent guilds of species. (A guild is a group of organisms that use the same environmental resources [such as habitats] in the same way.) By making a *focal* species the *priority*, and managing habitat for it, healthy ecosystems are supported for the benefit of multiple species. The point is to make sure that a focal species does in fact represent a broader guild.

The NCTC priority wildlife species (Table 5 below) require abundant and diverse species of aquatic and terrestrial invertebrates, as well as an abundance of emergent and submergent aquatic plant material, small mammals, fish, reptiles, and amphibians as food sources. Nesting and migrating habitat requirements include moderate density short to tall grasses, shrubs, early to late-successional deciduous forest plants, and both emergent and submergent aquatic plants.

Brief species accounts and habitat requirements for each of the priority species (identified in Table 5 as note "a") are included in Appendix B of this EA, and that appendix also contains complete lists of animals and plants that are known to occur at the NCTC.

The priority/focal plant species listed in Table 6 would be protected during treatments according to the resource protection measures listed in Table 4.

Table 5. Priority and focal wildlife species, habitat, and life-cycle activity

Priority Species	Life Cycle Activity	Priority Species	Life Cycle Activity
Grassland Habitat			
Loggerhead shrike	Breeding, Migration	Dickcissel	Breeding, Migration
Shrub-early Successional Habitat			
American woodcock[a]	Breeding, Migration	Field sparrow	Breeding, Wintering
Prairie warbler[a]	Breeding, Migration	Eastern towhee	Breeding, Wintering
Whip-poor-will	Breeding, Migration	Blue-winged warbler	Breeding, Migration
Deciduous Forest Habitat[b]			
Cerulean warbler[a]	Breeding, Migration	Scarlet tanager	Breeding, Migration
Wood thrush[a]	Breeding, Migration	Louisiana waterthrush[a]	Breeding, Migration
Kentucky warbler	Breeding, Migration	Nashville warbler	Breeding, Migration
Eastern screech owl	Breeding, Wintering	Worm-eating warbler	Breeding, Migration
Chimney swift	Breeding, Migration	Red-headed woodpecker	Breeding, Migration
Prothonotary warbler	Breeding, Migration	Yellow-bellied sapsucker	Migration, Wintering
Acadian flycatcher	Breeding, Migration		
Wetland/Riparian Habitat			
American black duck[a]	Wintering	Upland chorus frog	Breeding
Green heron[a]	Breeding, Migration	Eastern ribbon snake	Breeding, Wintering
American bittern	Breeding, Migration	Starnose mole	Breeding
Bank swallow	Breeding, Migration		
All Habitat			
Bald eagle[a]	Breeding, Wintering	Wood turtle[a]	Breeding, Wintering

Notes:

a. Indicates this priority species is also a focal species.

b. Forest breeding birds and shrubland/old field species are higher priority on Partners in Flight / Bird Conservation Region (PIF/BCR) lists than grassland birds (see http://www.nabci-us.org/map.html).

Table 6. Priority and focal plants

Priority Species	Habitat
Mottled joe-pye weed[a]	Grassland
Orange coneflower[a]	Grassland
Two-flower melic grass	Grassland
Smooth hedge-nettle	Grassland
Spreading sedge	Wetland/Riparian
Spreading rockcress[a]	Riparian (Limestone Cliffs)

Note:

a. Indicates this priority species is also a focal species.

Mean Annual Precipitation and Temperature

A knowledge of annual precipitation helps determine the ignitibility of vegetation and how susceptible a landscape would be to a wildfire, caused either by humans or lightning; it also helps predict the rate of spread of a fire if one were to start. Table 7 shows the average high, low, and mean temperatures and average precipitation for Shepherdstown, West Virginia. The average yearly precipitation is 38.1 inches. Precipitation and temperature affect vegetation growth and diversity (and also wildlife abundance and diversity) and can influence how vegetation would react to disturbance such as a wildfire.

Table 7. Average annual temperature and precipitation statistics for Shepherdstown, West Virginia

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average High[a, b]	38°	41°	52°	64°	72°	81°	85°	84°	77°	66°	54°	44°
Average Low	18°	21°	30°	38°	48°	56°	61°	58°	52°	40°	34°	24°
Mean	28°	32°	41°	51°	61°	68°	74°	72°	65°	54°	44°	34°
Average Precip.	2.6“	2.5”	3.1”	3.3”	3.8”	3.6”	3.8”	3.3”	2.9”	3.3”	3.1”	2.8”

Notes:

a. All degrees are in Fahrenheit

b. Data in the table were retrieved from http://countrystudies.us/united-states/weather/west-virginia/shepherdstown.htm

Predicted Fire Behavior

The National Fire Danger Rating System (NFDRS) is a set of computer programs and algorithms that allow land management agencies to estimate today's or tomorrow's fire danger for a given rating area. The system characterizes fire danger by evaluating the approximate upper limit of fire behavior in a fire danger rating area during a 24-hour period. Calculations of fire behavior are based on fuels, topography, and weather or what is commonly called the fire triangle. The NFDRS outputs give relative ratings of the potential growth and behavior of any wildfire. Fire danger ratings are guides for initiating presuppression activities and selecting the appropriate level of initial response to a reported wildfire in lieu of detailed site- and time-specific information. It links an organization's readiness level (or pre-planned fire suppression actions) to the fire problems of the day.

It is important to understand predicted fire behavior prior to conducting prescribed burns so that personnel implementing the burns can take all necessary safety precautions. Table 8 lists applicable current fuel models by land cover type, predicted fire behavior for the NCTC, and desired fire behavior. The application of the appropriate fire behavior model (see Appendix F) depends on observed grass fuel loads and compactness of forest litter, which vary seasonally. The predicted flame length and rate of spread were calculated using BEHAVE 4.0 for the following conditions: 6 percent fine fuel moisture, 20 mph surface wind speed, and 0.0 percent slope, with grass fully exposed to wind, forest litter partially exposed, and wetlands sheltered from wind.

Currently, only the grassland areas at the NCTC do not meet desired fire behavior (as shown in table 8). The 4-foot flame lengths are generally considered the limit for successful direct attack by firefighters with hand tools, and 8-foot flame lengths are the limit of control for engines with water. Therefore fuel reduction in forest and riparian areas is less of a priority than in the grassland areas, and would be used sparingly. Fire behavior fuel-type descriptors follow Scott and Burgan (2005).

Fire behavior predictions are based on Rothermel's (1983) "How to Predict the Spread and Intensity of Forest and Range Fires."

Table 8. NCTC land cover, fuel models, and fire behavior characteristics

Land Cover Type	Acres	NFDRS Fire Danger Model[a]	FBPS Fire Behavior Model[b]	Predicted Fire Behavior	Desired Fire Behavior
Grasslands	229	N or L	GR3 or GR6	10 – 22 foot FL[c] 133 – 248 feet/minute ROS[c]	2 – 4 feet FL ≤ 20 feet/minute ROS
Mixed-deciduous Forests	284	E or R	TL 6 (autumn) or TL 2(spring)	1 – 3 foot FL 1 – 7 feet/min ROS	2 – 4 feet FL ≤ 20 feet/minute ROS
Riparian/Wetland Areas	15	F	TU 2	4 foot FL 13 feet/min ROS	2 – 4 feet FL ≤ 20 feet/minute ROS

Notes:

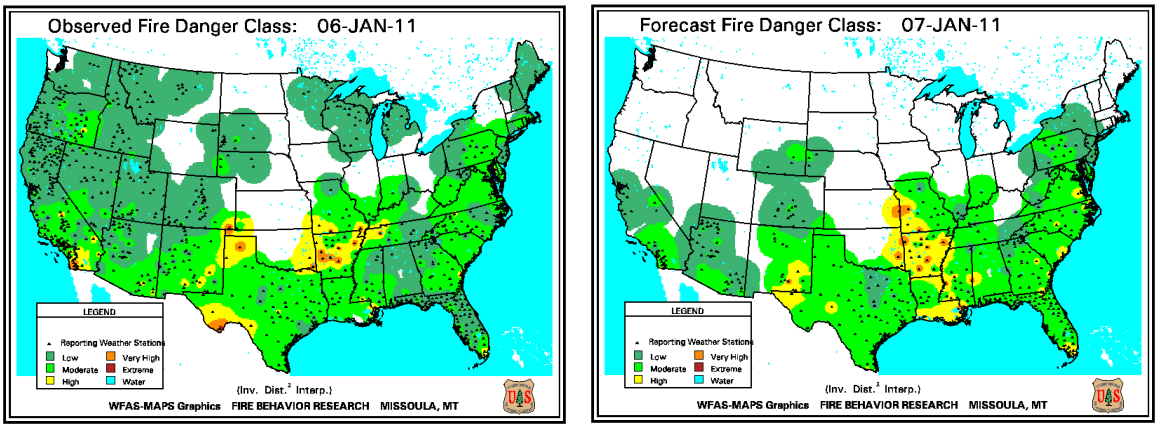
a. NFDRS = National Fire Danger Rating System — see Appendix F of this EA for definitions of each NFDRS Fire Danger Model or visit http://www.wrh.noaa.gov/sew/fire/olm/nfdrs.htm; also see http://www.fs.fed.us/fire/planning/nist/nfdr.htm.

b. FBPS = Fire Behavior Prediction System; see Appendix F of this EA for definitions of each FBPS Fire Behavior Model; also see http://fire.forestencyclopedia.net/p/p463.

c. FL = flame length; ROS = rate of spread (the length of the flames at the head of a fire is directly related to fire behavior)

West Virginia's official wildland fire season runs from March 1 to May 31 and October 1 to December 31. Each day during the fire season, national maps of selected fire weather and fire danger components of the National Fire Danger Rating System are produced by the Wildland Fire Assessment System, located at the United States Department of Agriculture Forest Service Rocky Mountain Research Station in Missoula, Montana. The current (observed) fire danger maps are available at http://www.fs.fed.us/land/wfas/fd_class.png (observed fire danger) and forecasted fire danger maps are available at http://www.fs.fed.us/land/wfas/fd_cls_f.png (forecast fire danger). Figure 1 shows examples of the two types of fire danger maps.

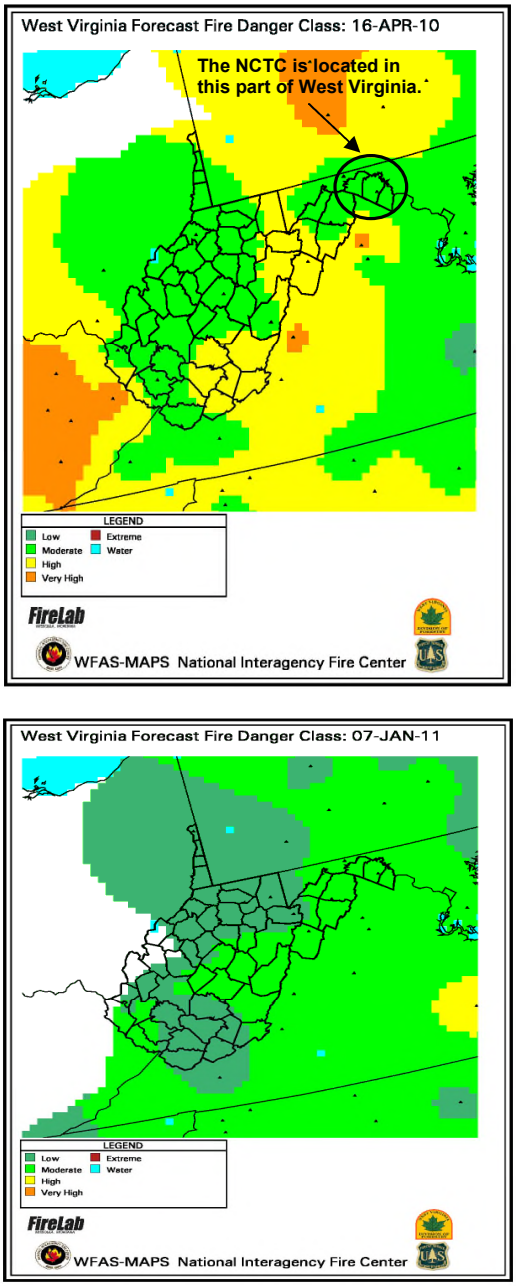
Figure 1. Examples of observed and forecasted fire danger maps



It is expected that the NFDRS weather station at Antietam National Battlefield (Antietam NB-180303 — about 6 miles from the NCTC) would eventually be used for the purpose of monitoring fire danger. The weather station is managed by the National Park Service. The National Fire Danger Rating System depends on an ordered set of weather records (indices) to establish conditions of the

day. These weather conditions, along with the NFDRS fuel models, are used to represent the day-to-day and seasonal trends in fire danger. There is currently insufficient data for an analysis of historic weather conditions for the NCTC area to be statistically valid using solely the Antietam data, so the analysis in the draft Fire Management Plan (see appendix D in that draft plan) made use of two other weather stations located further from the NCTC. These two stations are Martinsburg-461302 (about 10 miles from the NCTC) and Green Ridge-180201 (about 52 miles to the west of the NCTC). Data accuracy could only be accounted for within the last five years for the Green Ridge station; the two other stations had less reliable or fewer years available to establish break points for fire danger. See http://www.weatherforyou.com/places/us/md/antietam+national+battlefield/wxn7442.html for the Antietam weather station, which also contains a link to the Palmer Drought Index. The Palmer Drought Index was developed by Wayne Palmer in the 1960s and uses temperature and rainfall information in a formula to determine dryness. It has become the semi-official drought index. Refer to Appendix F of this final EA for additional information.

Figure 2. Examples of a wildfire danger rating in April 2010 and January 2011 by the West Virginia Department of Forestry



Source: http://www.wvforestry.com/wildfire_danger_map.cfm

Wildfire Potential Near the NCTC

The West Virginia Division of Forestry, in cooperation with the U.S. Forest Service and other state and federal agencies, monitors weather and fuel conditions. The agencies determine a fire danger rating for each portion of West Virginia. This danger rating changes on a daily basis as weather, vegetation, and fuel moisture conditions change.

Fires in this region are typically more likely to occur, and to be larger and more damaging, in the spring (March – April) and late fall (October – November). Maps showing the differences in fire danger on a typical spring day compared to a winter day are included in Figure 2. In these examples the fire rating is *Moderate* for the northeastern portion of the state. The *Moderate* rating (green on Figure 2) means fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel (such as invasive vines), may burn hot.

Short-distance spotting may occur but is not persistent. Fires are not likely to become serious and control is relatively easy (WVDF 2010; see also EACC 2010).

The majority of wildfires in West Virginia in 2008, for example, were caused by people and their carelessness. People who allowed debris fires to escape into the surrounding woods caused 35 percent of the fires; people who deliberately set fires (arson/incendiary) caused 26 percent; and people using equipment near or in the woods caused another 19 percent of all forest fires. The other 20 percent of forest fires in West Virginia were caused by campfires, children, smokers, and railroads. Some of that 20 percent were attributed to miscellaneous causes and lightning, and others are still under investigation. Since 2001 the lowest fire year was 2004 when 632 fires burned 6,022 acres; and the most fires occurred in 2006 when 1,022 fires burned 17,608 acres.

3.2.3.2 Scope of the Analysis

Analysis Area. Vegetation management activities have localized effects on vegetation attributes that are generally confined to the treated area. Therefore, the direct, indirect, and cumulative effects analyses of vegetation resources and wildlife are geographically bounded to the lands within the NCTC.

Analysis Period. The timeframe for the effects analysis is 2 years for short-term effects and up to 15 years for long-term effects on vegetation and habitat. This area has a relatively high rate of vegetation establishment and growth due to high annual precipitation and productive soils, and vegetation generally has sufficient opportunity to increase within the 2- and 15-year time frames.

3.2.3.3 Intensity of Effects Definitions

"Intensity" refers to the severity of effects or the degree to which the action may adversely or beneficially affect a resource. The intensity definitions used in this analysis are described below.

No Effect. The appropriate conclusion when it has been determined an alternative would not affect a resource, value, or process.

Negligible. An action would result in no observable or measurable effects on individual survival or on native animal and plant populations, their habitats, or the natural processes sustaining them. Occasional individual responses to disturbance could be expected but without interference to reproduction or other factors affecting survival.

Minor. An action would result in detectable effects on individuals or in small short-term changes to native animal and plant populations, but it would not be expected to cause any measurable long-term effects on native species, their habitats, or the natural processes sustaining them.

Moderate. An action would result in detectable effects on native animal and plant populations, their habitats, or the natural processes sustaining them. Key ecosystem processes may experience disruptions that would be outside the historic baseline or desired condition (but would return to baseline or desired conditions). Sufficient habitat would remain functional to maintain viability of native animal and plant populations.

Major. An action would result in large effects on native animal and plant populations, their habitats, or the natural processes sustaining them. Key ecosystem processes would be disrupted for long periods or permanently.

3.2.3.4 Measurement Indicators

There are six measures (or indicators) that were used to assess current conditions of habitat on NCTC property. These same indicators were used to assess effects of taking no action (Alternative A) and effects that could result from Alternative B or Alternative C (Proposed Action). The affected environment is described in terms of the amount and type of habitat present. The amount and type of habitat are described in terms of acres of each vegetative type currently present at the NCTC and that would be restored or maintained under each alternative.

1. Acres/percent of grassland habitat protected
2. Acres/percent of grassland habitat created, maintained, or restored
3. Acres/percent of mixed-deciduous forest protected
4. Acres/percent of mixed-deciduous forest created, maintained, or restored
5. Acres/percent of riparian/wetland areas protected
6. Acres/percent of riparian/wetland areas created, maintained, or restored

3.2.4 Affected Environment (Existing Conditions) and Environmental Consequences: Habitat and Wildlife

Three general vegetative communities (habitat types) occur on NCTC property: grasslands, mixed-deciduous forests, and riparian/wetland areas. The current conditions present are discussed first for each vegetative community, followed by effects of management actions on that habitat type and on the priority/focal wildlife species that are known to occur or may potentially occur at the NCTC. The priority/focal wildlife species that inhabit these vegetative communities were listed in Table 5 above. Appendix B provides brief species accounts for each priority/focal wildlife species because it is important to understand their breeding, nesting, and feeding habitats in order to understand how they could be affected by management activities. Appendix B also contains complete lists of plants and animals observed at the NCTC, with species listed by both common and scientific names.

3.2.4.1 Grassland Areas: Existing Conditions

Vegetation

There are approximately 229 acres of grasslands at the NCTC (refer to Map A-4). The grasslands fall into four basic types: (1) fallow cool-season grass fields; (2) cool-season grass fields managed for hay; (3) warm-season grass fields and areas of mixed grasses; and (4) forbs and woody plants. There are no fields planted in crops other than grass hay. All of these fields contain old fencerows or "rock-breaks" (linear limestone outcrops) that contain trees such as hackberry, black cherry, boxelder, tree-of-heaven, and black locust.

The *fallow cool-season grass fields* comprise approximately 79 acres. This vegetative community is located primarily in the western and central portions of the NCTC and offers a variety of habitat for upland wildlife species. The groundcover species consist of tall fescue, smooth bromegrass, orchard

grass, yellow foxtail, giant foxtail, plumeless thistle, bull thistle, purpletop, barnyard grass, Chinese mustard, dandelion, Queen Anne's lace, several species of goldenrod, milkweed, daisy fleabane, broom sedge, and wingstem, as well as a great variety of mostly nonnative weedy annuals. Tree species include boxelder, eastern red-cedar, American sycamore, black locust, and hackberry. Shrub species include multiflora rose, bush honeysuckles, and eastern red-cedar. The various fields are mowed or cut for hay on a rotating basis in order to keep woody plants and invasive exotic plants at bay. These fields are most likely to be flammable in late fall or early spring, though fire intensity is typically lower than warm-season grass under the same conditions.

The *cool-season grass fields managed for hay* currently comprise about 28 acres and are located in the southern and central portions of the property. One of the fields contains a cultural resource, known as the old racetrack. The grass species in these fields are primarily smooth brome grass, tall fescue, purpletop, orchard grass, red fescue, and bluegrass. The several fields are typically harvested in progression during the period from June through September. There are very few trees or shrubs in these fields. While thistles and Johnsongrass can be found in some of these fields, it is generally well controlled by the haying operation. Since cutting for hay removes much of the fuel, these fields have a low potential for wildfire.

The *warm-season grass fields* comprise about 75 acres and are located in the southeast part of the property, though one 6-acre section is located just southwest of the Entry/Auditorium Building. The native warm-season grasses that were planted in these fields include switchgrass, big bluestem, little bluestem, side-oats gramma, and Indian grass. Some of the fields have been fairly successful, while others are only sparsely populated with the planted grasses, typically switchgrass. The original plan was to use these areas for hay, at least on a rotating basis, once they were well established. However, only one warm-season grass field along Shepherd Grade Road was, until recently, cut for hay, which was done in the same manner as the adjacent cool-season grass fields. All of the warm-season grass fields contain weedy species typical of disturbed fallow fields, including downy brome, dandelion, curly dock, clover, annual wormwood, and Chinese mustard. Most notably, however, these fields contain varying amounts of state-listed noxious weeds such as Johnsongrass and various species of thistle. Plumeless thistle is the most common and noticeable, but there are also patches of the perennial and difficult-to-control Canada thistle. Bull thistle and musk thistle are found scattered throughout these fields. Some of the warm-season grass fields have been mowed in recent years, primarily to keep these noxious weeds from going to seed. Compared to the cool-season grass areas these fields have a greater volume and height of flammable fuel during the dormant season and can burn with greater intensity. Though prescribed burning is generally used in managing warm-season grass fields, no such burning has been done at the NCTC.

The *areas of mixed grasses, forbs (broadleaf plants), and woody plants* (typically nonnative shrubs and vines) are found on about 47 acres, including 38 acres of former crop fields and pastures and 9 acres of power line right-of-way. These areas, if left alone, would eventually become a forest, though likely one with an understory and mid-story dominated by nonnative plants. Two acres of this type of area were recently planted with native trees and shrubs, and further reforestation of such areas is planned.

Native cool-season grasses are present at the NCTC. Some, such as purpletop and red fescue, are typically found mixed in the fields with the nonnative cool-season grasses. Some, such as the wild

ryes, are found in the fields but are more common in field edges, riparian areas, floodplains, and other areas that are neither forest nor managed field. These are sometimes planted in with warm-season grasses and wildflower meadows. Native cool-season grasses are rarely the dominant cover for large upland areas.

Invasive plants are usually ones that tend to reproduce and spread quickly, out-compete native plants for resources (light, moisture, and soil nutrients), and establish themselves in areas where they are not wanted. Some of the worst invasive exotic plants were intentionally imported and sold for purposes of improving wildlife habitat and for ornamental and landscape uses, and many of them are still sold for these purposes. The priority invasive *exotic* (nonnative) plant species currently present at NCTC are listed in Table 9.

Table 9. Priority invasive exotic plant species requiring treatment at the NCTC

High-Priority Species		
Johnsongrass	Thistles (nonnative spp.)	Tree-of-heaven
Jetbead	Japanese hop	Mile-a-minute
English ivy	Oriental bittersweet	Winged euonymus
Any new infestation of any exotic species likely to spread is considered to be a high priority.		
Medium-Priority Species		
Phragmites	Garlic mustard	Bush honeysuckles (nonnative spp.)
Multiflora rose	Japanese honeysuckle	Japanese barberry
Japanese stiltgrass	Wineberry	Autumn olive
Low-Priority Species		
Other nonnative plants		

Wildlife

Grazing animals are attracted to the hay fields by the tender growth that occurs after cutting, along with the fact that these cool-season grasses are green and palatable in the fall, through much of the winter (if a mild winter), and in early spring—a period when most other grasses are not palatable. White-tailed deer commonly use all the fields, as do many other birds and mammals. The open grassy fields provide food and cover for small mammals and upland reptiles and amphibians, and the scattered trees and shrubs provide food and cover for songbirds and small mammals. The animals likely to be found in this type of habitat include mice, shrews, voles, moles, fox, groundhogs, and white-tailed deer. The observed bird species include turkey vulture, black vulture, barn swallow, and brown thrasher. Numerous species of small songbirds have been observed, including blue-gray gnatcatcher, eastern bluebird, chipping sparrow, and goldfinch (refer to Appendix B for a complete list).

The priority/focal species identified for grasslands and shrub–early successional habitats are the loggerhead shrike, dickcissel, American woodcock, prairie warbler, whip-poor-will, field sparrow, Eastern towhee, and blue-winged warbler (refer to Table 5 above and Appendix B).

Current Wildlife Management

Wildlife management at the NCTC property is primarily a passive management program through the manipulation of various habitat resources. The following are specific issues:

- NCTC will tolerate and encourage the presence of wild animals, much like that which occurs on National Wildlife Refuges. Toleration includes incidents of browsing and other damage to plants and trees, mole tunnels in the lawn, and swallow nests in the eaves. Exceptions can be made where such animal activities pose safety or health hazards or damage to NCTC facilities.

- White-tailed deer hunting on NCTC property has been allowed since the fall of 2003. This program is aimed at serving a dual purpose: first, as a herd population control strategy; and second, as a wildlife-related public use. The NCTC White-tailed Deer Hunt Management Step-Down Plan provides detailed information.

3.2.4.2 Grassland Areas: Desired Conditions

Vegetation. The desired condition is the establishment or improvement of 220 acres of grassland to native warm- and cool-season grasses or forest within the next 15 years. There will be a reduction in the acres of cool-season grasses—some of the acres will be converted to forest, either by planting or natural regeneration. Some areas may be planted with warm-season grasses, along with a mixture of native cool-season grasses and broadleaf plants. Nonnative grasses cannot be totally excluded, since they tend to re-occupy any vacant areas, and they do provide benefits for wildlife and prevent soil erosion.

The native grassland plant community should be predominantly warm season grasses such as big bluestem, little bluestem, switchgrass, Indian grass, Eastern gamagrass, deer-tongue, and broom sedge; along with a mixture of forbs such as wild columbine, butterfly weed, milkweed, wild blue indigo, wild bergamot, blazing star, black-eyed Susan, orange coneflower, partridge pea, various asters, Maryland senna, wingstem, and goldenrod. The desired native cool-season grasses are Canada wild rye, Virginia wild rye, purpletop, and red fescue. The scientific names for these species can be found in Appendix B. This mixture of grasses and forbs would provide a diversity of height from approximately 6 inches to 6.5 feet. Periodic burning will help maintain these areas with less need for other resources and should eventually lead to dominance of native over nonnative grasses.

Wildlife. There will not be a loss in wildlife presence and diversity, and over the years, wildlife diversity will increase due to the availability and abundance of suitable habitat in the grassland areas.

3.2.4.3 Grassland Areas: Environmental Consequences

Alternative A — Direct and Indirect Effects from Activity 1: Continue Mowing and Activity 2: Continue Haying

Vegetation. Long-term beneficial minor to major effects would persist as management actions continue to maintain and restore healthy, diverse habitat.

Actions under Alternative A would tend to support a balanced combination of grasses and forbs that provide habitat availability and diversity for the year-round wildlife at the NCTC and for the migratory bird species that use, or could potentially use, NCTC lands for breeding and migration. However, since the grasses are kept relatively short during the growing season, the portions of the grasslands that are managed for hay do not contribute significantly to habitat for the small mammals

and birds that would normally nest there. Also, since late spring through mid-summer is a prime time for grassland bird nesting, any birds nesting there would likely be evicted and their nests disturbed or destroyed.

Late-summer mowing (late July and August) of native warm-season grasses tends to suppress them and helps develop and maintain nonnative cool-season grasses, as well as native cool-season grasses such as red fescue and the wild ryes and some forbs, especially spring-flowering species such as ragwort and beardtongue. Other native forbs (such as asters, coneflowers, wingstem, milkweed, and bergamot) and warm-season grasses benefit more from mowing in the dormant season during late winter to early spring (prior to bird and small mammal breeding season) or late fall (USGS 2010d).

The key to responding to the needs of the various native grasses and forbs is to balance actions by rotating activities from year to year and from field to field—this is already being practiced at the NCTC. Mowing is planned on a rotating basis for all of the native warm- and cool-season grasslands, and rotations occur seasonally and annually on a two- to three-year basis. Rotations also help promote conservation of undisturbed or idle habitats for grassland wildlife. Grasses are not mowed shorter than 4 inches (higher when possible), which allows grasses a much quicker growth response and maintains a healthier stand—beneficial effects for both vegetation and wildlife. The bales are also removed quickly to avoid killing spots and disturbing re-nesting wildlife.

Some nonnative grass species, such as Johnsongrass and Japanese stiltgrass, are very invasive and considered a serious problem. Some other nonnative grasses do spread and occupy open areas but are considered to be desirable for pasture or hay, as food for deer and other grazing animals, and as habitat for small mammals. Haying or mowing tends to favor low-growing cool-season grasses. Although some cool-season grass may be desirable for diversity, they may eventually dominate an unmanaged stand, and the more space cool-season grasses take, the less open ground remains for annual forbs and movement of wildlife (MDC 2010). When this occurs, adverse effects could be minor to moderate and both short and long term if habitat use, quality, and diversity are reduced, which is contrary to grassland objectives 1 and 2 in this EA.

Wildlife. Mowing and haying could result in temporary negligible to minor adverse effects on wildlife species. Long-term minor to major beneficial effects would persist as management actions continue to maintain and restore healthy, diverse habitat.

The native warm-season grasses at NCTC provide generally good bird habitat for nesting/roosting, brood rearing, and escape. Mowing and haying warm-season grass areas can affect birds in various ways; some species will

- abandon fields mowed during breeding activities
- remain in cut fields to re-nest or increase in density after mowing
- colonize recently cut fields to forage
- benefit by habitats that are mowed in late summer or early fall

Currently, most warm-season grasses are not mowed from mid-May through the end of July (after the breeding and nesting season for most birds and other grassland wildlife). This ensures that wildlife using the grasslands for life-cycle activities (breeding, nesting, and brood rearing) are not adversely affected. Most species have had a chance to raise at least one brood if mowing is delayed

until the middle or later part of July. Some species (such as dickcissels and sedge wrens) are late nesters and are less affected when mowing does not occur until early August (USGS 2010d). By then most fledglings and young mammals would not be adversely affected because they are able to flee the area being mowed or safely retreat underground. In addition the grass fields at the NCTC are surrounded by alternate habitat for escape or use by some species that may re-nest after mowing-induced failure of first nest attempts (USGS 2010f).

Some wildlife will benefit when warm-season grasses are not mowed until late winter and early spring because this leaves protective cover on the ground during the winter months for the wintering wildlife species. While some wildlife may be temporarily affected due to disturbance during mowing and haying activities, they will be greatly benefitted in the long term by the availability and maintenance of diverse high-quality habitat. The deer at the NCTC feed mainly on the nonnative cool-season grasses in the fall, winter, and early spring. The cool-season grasses provide other benefits such as erosion control, food (directly by being edible and indirectly by producing edible insects or small mammals), and cover for wildlife other than deer. Therefore, the presence of some areas of cool-season grasses will continue to benefit some wildlife.

Alternative C — Direct and Indirect Effects from Activity 1: Continue Mowing and Activity 2: Discontinue Haying

Vegetation. Changing land use for the hay fields to less intensively managed cool- and warm-season grasses would provide improved habitat conditions, especially for nesting wildlife. Thus, effects would be beneficial and minor to major over the long term.

Eliminating haying would allow taller and more diverse herbaceous vegetation in those fields. Through volunteer regeneration of other grasses and forbs, the thick but short cool-season grasses now in place would gradually be mixed with other species. If mowed on a rotating basis of approximately three years between cuttings (depending on the needs of each individual field), woody vegetation could probably be kept from overtaking the grasses and forbs. The best time to mow these cool-season grasses would be late summer after the primary nesting season, although late winter / early spring is an option if an additional mowing is needed. Mowing would need to be supplemented with spot spraying of herbicide to control noxious weeds, other invasive exotic plants, and invading woody plants. Management of these fields, under Alternative C, would also include periodic prescribed burning. Planting of warm-season grasses, forbs, and/or native cool-season grasses would also likely be carried out in one or more of the fields. The effects of mowing were presented above.

Wildlife. The cessation of haymaking would allow improved habitat for breeding, nesting, and brood rearing. Any mowing or other disturbing activities could be carried out with greater freedom—at a time and in a manner that would be better for wildlife. Since these fields are mostly contiguous, this would create a large area of grassland habitat comprised of a mixture of warm-season and cool-season grasses, incorporating large and small patches of trees and shrubs.

Alternatives A and C—Direct and Indirect Effects from Activity 3: Continue Planting Desired Species

Vegetation. Continuing to plant desired species would produce both short- and long-term beneficial effects on surrounding native vegetation and wildlife species that depend on native vegetation.

Prior to the establishment of the NCTC, past land use practices have altered vegetation from its original conditions. The loss of native vegetation has occurred over the years, primarily through farming, which included vegetation clearing, cultivation, planting of nonnative grasses for grazing and hay production, and grazing itself. Native vegetation has also been lost due to fire exclusion. Continuing to restore former agricultural fields to a native grassland biological community would result in both short- and long-term beneficial effects by providing favorable feeding, breeding, and wintering habitat for a diversity of grassland-dependent migratory birds, native pollinating invertebrates, and other native wildlife that are present.

Short- and long-term moderate to major beneficial direct effects would result from the continued planting and management of a variety of desired native grass species (both warm- and cool-season grasses) and forbs. The diverse vegetation will give structure to the grasslands with small plants that grow near the ground and medium-sized plants and tall thick-stemmed grasses that stand up to the wind. Completing the restoration of the 76 acres of these fields to native grasses would benefit the other vegetation and the wildlife that inhabit grasslands. Native warm-season grasses would be planted on an additional 10 acres of former hay field and a small area of existing cool-season grass. Existing warm-season grass fields that have poor establishment would be reinforced with additional seedlings. Along with the conversion of some existing warm-season grass area (typically less successful sites adjacent to woodlands), this would bring the total area of warm-season grasses to 79 acres.

The remaining 73 acres of fallow cool-season grasses would be managed by planting, rotational mowing, disking, and targeted herbicide application to increase the population of native grasses (both warm- and cool-season) and forbs. The management activities that would continue to occur in grassland habitat under Alternatives A and C would produce short-term beneficial effects that may range from minor to moderate, depending on the amount of habitat that can be maintained or restored each year, and moderate to major long-term beneficial effects if habitat is continually managed.

Maintaining low-growing grass and forb strips, along warm-season grass field borders and as interior strips, would provide habitat diversity and also serve as fire breaks, control lines, and access routes during prescribed burning activities, the managed deer hunt, invasive plant control, or in the event of a wildfire. The grass strips would be planted with low-growing native grasses and forbs. Once established they would be mowed once or twice per year during late summer and/or late winter. These cool-season grasses “green up” much earlier than the warm-season grasses, so they are less flammable in early spring (prior to most nesting and breeding activities) when most prescribed burning would be done, and they are generally more shade tolerant than warm-season grasses. There are some grass strips at the NCTC, but more would be created and improved under Alternatives A and C.

Wildlife. All wildlife species that inhabit grassland areas would benefit from a greater abundance of native grass and forb species. Restoring and maintaining native plant species provide the diverse structure in grass fields that creates cover and nesting sites for an array of grassland-dependent wildlife that already inhabit NCTC lands or more that could in the future. Native warm-season grasses provide nesting, brood rearing, escape, and roosting cover. The presence of forbs in managed grasslands is important because they diversify structure and invertebrate resources. Several

bird species, such as the dickcissel and savannah sparrow, are most abundant in fields with a strong forb component. Plant diversity increases food sources, such as seeds, in addition to increasing the number of different insects that use a grassland area, and insects are an extremely important food source for young birds as they begin to grow and fledge. The cool-season grasses provide ideal cover strips when planted and maintained along the edges of warm-season grass fields, roadways, fence rows, and woodland edges. The inclusion of forbs and native shrubs would provide additional diversity as a "soft edge" transition zone between the grass field and woodland areas.

Alternatives A and C—Direct and Indirect Effects from Activity 4: Continue Chemically Treating Undesirable Species

Vegetation. The continued management of invasive plants would result in long-term minor to major beneficial effects on native vegetation.

When haying, mowing, and other methods (such as hand pulling or use of a weed trimmer, chainsaw, and brush cutter) do not achieve the desired results in grasslands, herbicides are used as another control mechanism to meet the goal of eliminating nonnative cool-season grass species and invasive exotic plants. Eradicating invasive plants with herbicides results in beneficial effects on the native grass species because treatments help reduce competition for resources (such as soil nutrients, sunlight, and moisture) and promote diverse native grassland plant communities, and few weeds can compete with healthy native grasses for nutrients and water in the soil. Weed control is also necessary for site preparation prior to planting the desired species, which occurs under Action 3 above.

The primary adverse effect that could result is if herbicides were sprayed on susceptible nontarget vegetation—this could occur through drift. The NCTC and National Park Service herbicide application crews avoid drift damage by observing practices such as spraying when the wind speed is less than 10 mph, using nozzles that reduce drift potential, or using alternative application methods. Similar damage could occur when the nontarget species is intermingled with the target species. In that situation a selective product (one that does not affect certain nontarget species) may be used, or a directed application may be used to prevent or reduce application onto the nontarget plants, applying treatment at a time when the nontarget plants are dormant. In some cases a certain amount of damage to common species of nontarget plants is acceptable. Other precautions are taken, such as creating herbicide-free buffers around sensitive areas and nontarget plants and shielding nontarget and sensitive plants with suitable material, such as a tree shelter, bucket, or other means (refer to Table 4 above for the resource protection measures). The proper use of herbicides would not result in anymore than negligible to minor adverse effects on nontarget plants in the short term, and long-term minor to major beneficial effects on native vegetation as invasive exotic plants are controlled and eradicated.

There is the potential for four priority/focal plant species (mottled joe-pye weed, orange coneflower, two-flower melic grass, and smooth hedge-nettle) to occur in the grassland areas (refer to Table 6 above). Pre-treatment field reviews and implementation of resource protection measures (refer to Table 4) would serve to protect these plants if they are observed at the NCTC.

Wildlife. The herbicides would pose either no risk or a slight risk to birds and no risk to mammals and insects; therefore, any adverse effects would be negligible or discountable. The

implementation of the resource protection measures would mitigate any potential adverse effects to the negligible level.

All pesticides sold in the United States must be accepted for registration by the EPA based on a minimum of 120 scientific studies that show the pesticide will perform its intended function without unreasonable adverse effects on humans, animals, and the environment. The EPA defines unreasonable adverse effects as any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of the pesticide. The effects of such products can be obtained from EPA's "Prevention, Pesticides, and Toxic Substances" webpage (see Appendix E for Internet locations of EPA fact sheets and other websites for detailed information on pesticides)

Herbicides currently or potentially used in grasslands at the NCTC are, in approximate order of area treated: Accord Concentrate and similar glyphosate products, Milestone VM, Escort XP, Outrider, Garlon 3A, Plateau, and Garlon 4 Ultra. Further information on these products can be found in Appendix E. Detailed information on these pesticides can be found at http://www.epa.gov/pesticides/.

- Accord Concentrate (active ingredient is glyphosate). Glyphosate is used at the NCTC for control of exotic plants such as Johnsongrass and Japanese stiltgrass, as well as other plant species in landscape and reforestation sites.

  The EPA has determined (based on current data) that the effects of glyphosate are minimal on birds, mammals, fish, and invertebrates. The nature of glyphosate residue in plants and animals is adequately understood. Most of the glyphosate (from ingestion) in animals is eliminated in urine and feces. Metabolism studies in rats show that most (97.5 percent) of the glyphosate directly administered was excreted in urine and feces and less than 1 percent of the absorbed dose remained in tissues and organs. A second study using rats showed that very little glyphosate reaches bone marrow, that it is rapidly eliminated from bone marrow, and that it is even more rapidly eliminated from plasma.

- Milestone VM (active ingredient is aminopyralid). Aminopyralid is used at the NCTC for selective control of thistles and certain other invasive broadleaf weeds and woody plants.

  Aminopyralid has been shown to be practically nontoxic to birds, fish, honeybees, earthworms, and aquatic invertebrates. It is slightly toxic to eastern oyster, algae, and aquatic vascular plants. In a metabolism study in rats, aminopyralid was rapidly absorbed, distributed, and excreted following oral administration.

- Escort XP (active ingredient is metsulfuron-methyl). Metsulfuron-methyl is used at the NCTC for control of multiflora rose, thistles, tree-of-heaven, and certain other invasive broadleaf weeds and woody plants.

  The acute toxicity data indicate that metsulfuron-methyl has low acute oral, dermal, and inhalation toxicity. It has as low toxicity to mammals, birds, and insects and does not bioaccumulate in warm- or cold-blooded animals.

- Outrider (active ingredient is sulfosulfuron). Sulfosulfuron is used at the NCTC to control Johnsongrass in warm-season grass fields.

Toxicity tests on mice and rabbits show that sulfosulfuron is slightly or practically nontoxic and does not cause mortality. Tests also show it is practically nontoxic to birds and invertebrates, and no more than slightly toxic to freshwater fish.

- Garlon 3A (active ingredient is triclopyr triethylamine or triclopyr TEA). This product is used for spot treatment of thistles, multiflora rose, and other nonnative broadleaf weeds and woody plants. This product has little or no effect on grasses. This form of triclopyr was found to be slightly toxic to birds (bobwhite and mallard) and practically nontoxic to fish (bluegill and trout), though negative results were only observed at very high exposure levels. Tests on livestock grazing of treated forage have shown that triclopyr does not bio-accumulate but moves through the animals essentially unchanged and is excreted in their urine (DAS 2010a, 2011).

- Plateau (active ingredient is imazapic [ammonium salt of imazapic; imazapyr salt]). Imazapic would be used at the NCTC for control of Johnsongrass and other invasive grass weeds in warm-season grass fields.

  The EPA has determined that there are no risks of concern to terrestrial birds, mammals, and bees or to aquatic invertebrates and fish.

- Garlon 4 Ultra (active ingredient is triclopyr butoxyethyl ester or triclopyr BEE). This product is used strictly for basal bark treatment to the stems of individual invasive trees and shrubs. It has little or no effect on grasses. This ester form of triclopyr is moderately toxic to birds and fish. The ester form hydrolyses rapidly to the acid form, and for this reason, researchers have concluded there is little chance the ester would impact these organisms. As with the amine form of triclopyr, this product does not bio-accumulate (DAS 2010a, 2011).

Some of these products may no longer be used in the future, and other products may fill the same role as new invasive exotic pest plants are located, or products with improved effectiveness on certain species and/or increased safety or selectivity are developed. Any new or additional products to be used would not have greater toxicity than the products described above and would need to be approved for use through the FWS Pesticide Use Proposal process.

Alternative C—Direct and Indirect Effects from Activity 5: Proposed Use of Prescribed Fire

Vegetation. The effects of prescribed fire would be beneficial, in both the short and long term. Native grasses and forbs have greater seed production, germination, and establishment after a fire because burning allows plant nutrients to be returned to the soil and used again. Fire removes the existing undesirable cool-season grasses above the soil surface and promotes the growth of native grasses and forbs, providing a competitive advantage for the native species.

A prescribed burn is a managed fire conducted under a special set of guidelines for weather and safety. The humidity level, wind speed, wind direction, temperature, and smoke conditions are among factors that must be correct for the burn to occur (these factors are included in a burn plan that will be prepared prior to implementation of any prescribed burn).

Fire kills woody plants, allowing sunlight to reach the soil and changing the soil pH and nutrient availability. Native grasses and forbs have greater seed production, germination, and establishment after a fire because burning allows plant nutrients to be returned to the soil and used again. Fire helps

retard the growth of undesirable cool-season grasses and promotes the native grasses and forbs, improving the competitive advantage of the native species. The productivity of native plant species usually increases following a fire, and growth is stimulated by the removal of litter and preparation of the seedbed (mowing is not a good replacement for fire because it does not reduce plant litter) (NIFC 2010b; USFWS 2010c).

The effects of prescribed fire would be beneficial, in both the short and long term. The duration and degree of beneficial effects would be influenced by the frequency (such as a two- to three-year cycle) of the prescribed burns and the number of acres burned at the NCTC in a given cycle. Plant recovery following a fire is fastest in spring and fall when soil moisture is high and plants are not producing seeds (NIFC 2010b).

The potential for a prescribed burn to grow beyond the planned burn area would be minimal when the burn is implemented according to the guidelines established in the burn plan. In addition, grass provides a low-quality fuel (particularly in the eastern United States during average weather conditions), so grass fires are not as intense as those that occur in drier regions of the country.

Wildlife. The effects of prescribed burns on wildlife can be both adverse and beneficial. The improved habitat that results from the use of prescribed burning is a benefit to wildlife. There could be temporary negligible to minor adverse effects on small animals if they are unable to escape to safe areas during a prescribed burn.

Fire removes dry, dead plant matter that has built up over the years, opening up space for new growth, and creating thicker, younger cover and increasing food availability by stimulating seed production (USFWS 2010c). Habitat improved by a prescribed burn provides better nesting cover and attracts ground-nesting birds (such as the dickcissel and sedge wrens). It also provides improved brood-rearing habitat by increasing the amount and variety of food available for young birds.

Birds and some mammals usually leave the area ahead of a fire (USFWS 2010c). Few animals are unable to escape fire, and small mammals, reptiles, and amphibians that inhabit grasslands find shelter by burrowing under a log or staying in an underground burrow. Any nests destroyed by the fire are usually replaced through renesting (*ibid.*). Adverse effects on NCTC wildlife would be minimized by planning spring burns early enough to avoid the breeding and nesting season of most wildlife.

Alternatives A and C—Cumulative Effects

The high deer population at NCTC contributes to the occurrence and spread of invasive plant species by the transport of seeds on hooves and hide, disturbance of soils, and the killing or suppression of native plants. Continuing to monitor and control the white-tail deer population on NCTC would benefit native grasslands by reducing the number of deer that browse native vegetation and spread invasive plant seeds. Managing grasslands in concert with controlling deer populations would result in long-term minor to major beneficial cumulative effects, commensurate with the level of management actions that are implemented in a given year and over time.

Alternative B—Direct and Indirect Effects

Vegetation. Ceasing all land management actions at the NCTC could have long-term major adverse effects as the native grasslands gradually convert to nonnative invasive plant communities.

Areas left idle would likely develop an excessive amount of plant litter, which would retard plant growth. A few species become dominant when a native grass stand is unmanaged for too long a period. Such "stagnant" stands are so dense that wildlife cannot enter them, making them unusable for wildlife cover and making it difficult for wildlife species to get to the insects and seeds available in the stand (MDC 2010). Wildlife use of native grass fields increases when management involves one or more techniques (such as mowing and prescribed fire). When nonnative cool-season grasses are left unmanaged, they will eventually dominate a stand. The more space cool-season grasses take, the less open ground remains for annual forbs and movement of wildlife.

Nonnative plants have become established and continue to be introduced to NCTC lands via birds; seeds that are carried by wind; seeds or plant parts that hitchhike on animals, people, vehicles, and equipment; or by water via the Potomac River. In the absence of any type of treatment to control invasive plants, they will out-compete and displace native plants and lead to changes in species composition, vegetation structure, and soil chemistry. Currently, in some areas at the NCTC, invasive plants have taken over to a degree that they have become the dominant vegetation—this will only worsen over time by not controlling invasive plants and replanting with native species. The lack of management could lead to monocultures (plants of only one species in a particular area) rather than an ecosystem that supports plant and animal diversity.

Wildlife. The replacement of native plants with nonnative plants would cause long-term adverse effects on the native insects, birds, and animals that are adapted to living and reproducing along with native plants. For example, native insects, birds, and animals sometimes readily feed or reproduce on nonnative plants, leading one to think that this is beneficial. However, this can negatively affect their diet, lead to mortality or reproductive failure, make them vulnerable to pests and predators, or prevent the pollination or seed dispersal of native plants.

Alternative B—Cumulative Effects

Continuing to monitor and control the white-tail deer population at the NCTC will benefit native grasslands by ensuring the deer do not over browse native vegetation that survive in the absence of any land management actions. Nonnative plant species will proliferate without any actions to minimize or eradicate them. As native plant species are overtaken by invasive nonnative species, wildlife may begin migrating in search of suitable habitat off NCTC property. Choosing Alternative B would result in minor to moderate adverse cumulative effects in the short term, but as time goes by, effects would shift to moderate to major as native habitats are converted to monocultures of nonnative plants that may be unusable for many wildlife species. Alternative B would not meet the NCTC objectives for grassland habitat.

Alternatives A, B, and C—Effects of a Wildfire

Vegetation. The effects of a wildfire on vegetation could be both beneficial or adverse and range from minor to moderate in the short and long term, depending on variables that can affect fire behavior such as topography, temperature, humidity, wind speed, and structure of the plant community. Native grasses and forbs have greater seed production, germination, and establishment after a fire (both prescribed fire and wildfire) because burning allows plant nutrients to be returned to the soil and used again. Fire would remove the existing undesirable cool-season grasses above the soil surface and promote the growth of native grasses and forbs, providing a competitive advantage for the native species.

The condition of grass fields in northeastern West Virginia can become similar to the grasslands in other parts of the country if low humidity and high temperatures during summer and early fall lead to very flammable conditions. However, the average weather conditions in northeastern West Virginia are that of higher humidity levels and higher moisture content of vegetation. Under those average conditions, the effects of a wildfire in the grass fields would likely be short term and range from minor to moderate, depending on the size of the wildfire and time of year it occurs. During drier or drought-like conditions, a wildfire would readily ignite dry or dead vegetation and could result in moderate to major adverse effects on both vegetation and wildlife.

There could be some level of increased fire risk under Alternative B due to accumulations of ground fuels, such as dead plant litter, in the absence of any vegetation management actions.

Wildlife. The effects of a wildfire on NCTC wildlife in the grass fields would likely be short term and range from minor to moderate, depending on the size of the wildfire and time of year it occurs. There could be temporary negligible to minor adverse effects on small animals if they are unable to escape to safe areas during a wildfire.

Fire serves as a natural disturbance to an ecological setting. Some wildlife species are able to adapt to the rapid change in environment and some cannot. Following a wildfire, habitat for some species can be greatly improved, while for others it may be degraded, if not eliminated, and there may be endless variation in between. No fire—either wild or prescribed—results in uniformly beneficial or adverse effects (NIFC 2010a, b). Birds and some mammals can easily escape the fire, and small mammals, reptiles, and amphibians that inhabit grasslands may escape to their underground burrows, dens, and nests.

3.2.4.4 Mixed-Deciduous Forests: Existing Conditions

There are approximately 284 acres of mixed-deciduous forest at the NCTC (refer to Map A-4).

Vegetation

Mature Hardwood Forests. The older/mature hardwood forests comprise approximately 65 acres and occur on the edges of the NCTC, including the north-facing slopes and ravines overlooking the river, along the Terrapin Neck Road property boundary, and along the western fence line of the property. The boundaries of this forest type today correlate well with those areas under forest canopy as shown in a 1938 aerial photograph (see Figure 3). Tree ring cores taken from several of the larger trees suggest some of the trees were established in the 1870s.

The overall species composition of this forest type is very diverse and contains the highest concentration of native species. There is nearly complete canopy closure, and the dominant overstory species are tulip-poplar, red oak, black oak, bitternut hickory, black walnut, green ash, beech, sugar maple, American elm, and hackberry. The forest has been selectively cut in the last 25 years and has had some impacts from past cattle grazing. Some portions have canopy openings that allow dense concentrations of invasive nonnative species such as multiflora rose, wineberry, bush honeysuckles, and Japanese honeysuckle to dominate the understory, particularly near the forest edges. The mid-canopy is often dense and consists of sugar maple and hackberry saplings. The shrub layer (understory) in the shadier portions contains the native shrubs spicebush, pawpaw, blackhaw, and flowering dogwoods that have become denser since cattle grazing was discontinued in the mid-1990s.

Redbud can be found near the sunnier edges of the understory. The groundcover layer is lush in the portions along the river and sparser on the adjacent slopes.

Figure 3. Aerial photo taken in 1938 of what is now the NCTC

Along Terrapin Neck Road and the north-facing slope overlooking the river, the understory herbaceous plants exhibit a fairly high percentage of native species, including spring wildflowers such as mayapple, ramp (wild leek), squirrel corn, Dutchman's breeches, twinleaf, wild ginger, cut-leaf toothwort, spring beauty, trillium, and yellow trout lily. The western fence line tends to have fewer native herbaceous plants because of recent grazing by beef cattle, but it does contain an intact stand of older beech trees.

In the forested areas that were grazed or otherwise disturbed in more recent times, the understory herbaceous plants tend to be composed of white snakeroot and exotics such as Indian strawberry, Japanese stilt grass, garlic mustard, chickweed, and beefsteak plant. The edges of this forest type, including the interior gaps that allow increased sunlight, are commonly overgrown with vines and shrubs including natives such as wild grape, Virginia creeper, greenbrier, and poison ivy; and invasive exotics such as Japanese honeysuckle, Japanese stiltgrass, multiflora rose, tree-of-heaven, autumn olive, thistles, Johnsongrass, tall fescue, and wineberry. Because these forest patches were selectively

cut and occasionally grazed by beef cattle over the years and have a high edge-to-area ratio, they commonly take on many of the characteristics of a younger, more highly disturbed forest. The steep ravines and slopes in the northeast corner of the NCTC and portions of the woods along Terrapin Neck Road have the most intact native species composition.

Groundcover species near the river include a much higher percentage of native plants, including such spring wildflowers as wild ginger, trillium, enchanter's nightshade, mayapple, and Virginia bluebells.

Immature Hardwood Forest. The immature/younger hardwood forests are mainly located in the central, northeastern, and southwestern portions of the NCTC and comprise 200 acres. The younger forested areas correlate well with those areas now forested but were once open pasture or croplands in the 1938 aerial (refer to Figure 3 above). These areas have grown nearly as tall as or taller than the older forest patches and, in some areas, have a nearly closed canopy but can still be recognized by the tree and understory species composition. The canopy is sparse in many places due to differently aged patches of trees within the same stand, past logging, the decline of early successional species such as black locust, and the mortality of most of the elms due to Dutch elm disease. This has resulted in a dense understory and considerable vine growth in the canopies of the overstory trees. The dominant overstory species are yellow poplar, sycamore, boxelder, black walnut, various oaks, and tree-of-heaven. The understory is dense and consists of multiflora rose, spicebush, pawpaw, bush honeysuckles, Japanese barberry, wineberry, and boxelder. Vine species prevalent throughout the plant community include Japanese honeysuckle, Virginia creeper, poison ivy, grape, and greenbrier. Groundcover species include white snakeroot, garlic mustard, Japanese stiltgrass, beefsteak plant, Indian strawberry, and ground ivy. The herbaceous understory is composed of a lower percentage of native plants; native spring wildflowers are often difficult to find.

New Forest. Within the last 15 years, approximately 19 acres of new forest has been established. This is on previously farmed fields on floodplains and terraces of the Potomac River. When cropping ceased, mostly as a result of repeated flooding in 1996, the seeds of nearby trees found a receptive seed bed in the exposed soil. Some areas already had grass cover, which made seedling establishment occur later and slower. Some of sections of the fields were maintained as fields for a time by mowing. Thus, the trees within the same fields/stands range in size from small seedlings up to trees four or more inches in diameter. By far, the greatest numbers are boxelder; however, a significant number of young sycamore saplings are found in some areas, and a few silver maples are present. Few other tree species are found, and the tree regeneration (greater than 10,000 stems per acre) is usually so dense that almost all understory and groundcover is shaded out. In sections where the tree regeneration is not yet dominant, various grasses and forbs, both native and nonnative, are found.

Wildlife

The mixed-hardwood forests offer an extremely diverse habitat for wildlife and support a variety of mammals, reptiles, amphibians, and birds. White-tailed deer, eastern gray squirrel, fox squirrel, eastern cottontail, striped skunk, groundhog, and raccoon have been identified, as well as eastern box turtle, wood turtle, northern dusky salamander, black rat snake, and American toad. Several smaller species of mammal, such as mice and shrews, also occur in this plant community.

Bird species include pileated and red-bellied woodpecker, Carolina chickadee, tufted titmouse, yellow billed cuckoo, Baltimore oriole, and red-eyed vireo.

Some of the same wildlife species that use the mature hardwood forests will also use the immature hardwood forests, except for those species that require a closed canopy and large trees typical of a mature forest, such as the pileated woodpecker. This vegetative community is also used by some of the same species found in the grassland areas, such as white-tailed deer and eastern gray squirrel.

The priority/focal species that prefer mixed-deciduous forests include the cerulean warbler, wood thrush, Kentucky warbler, eastern screech owl, chimney swift, prothonotary warbler, scarlet tanager, Louisiana waterthrush, Nashville warbler, worm-eating warbler, red-headed woodpecker, and yellow-bellied sapsucker (refer to Table 5 and Appendix B).

3.2.4.5 Mixed-Deciduous Forests: Desired Conditions

Ideally, all the forest land at the NCTC should consist of a wide variety of native trees, shrubs, and herbaceous plants, along with a similar diversity of native wildlife of all types. Both shade-tolerant and intolerant tree species would be present. All ages of trees would be present, though not necessarily all in the same stand—some areas would be regenerating forest while others are immature or mature. Nonnative plants and animals should be reduced to a low and ever-diminishing proportion of the biotic community. Near closed-canopy conditions should exist in most areas, with small and large gaps created by natural mortality, storms, floods, and native insects and diseases. Regeneration of native trees and shrubs would already be present or quickly become established once these gaps appear. Dead trees would be plentiful in the form of standing snags and coarse woody debris on the ground, though not to the degree that they would be a major hazard in the event of a wildfire. The NCTC is meeting its objective to eliminate most invasive nonnative plants on approximately 5 acres of forest habitat annually. Approximately 25 acres have been restored to a community of native mixed-deciduous forest habitat by natural regeneration and planting. Gaps and narrow sections in the largest, most contiguous areas of existing forest cover are in the initial stages of being restored to native plant communities. The forests continue to provide habitat for cavity nesting species because snags are left standing in areas where they do not pose a safety hazard to staff and visitors.

3.2.4.6 Mixed-Deciduous Forests: Environmental Consequences

Alternatives A and C—Direct and Indirect Effects from Activity 1: Continue to Re-establish Desired Species

Vegetation. All activities intended to maintain, restore, and increase diversity in a native mixed-deciduous forest biological community would result in beneficial effects that range from minor to moderate in the short term and moderate to major in the long term as nonnative invasive species are reduced or eliminated, and native trees, shrubs, and forbs become the primary habitat components.

Wildlife. Continuing to plant desired species and increasing the amount of native mixed-deciduous habitat would produce both short- and long-term moderate to major beneficial effects on wildlife species that depend on native vegetation for breeding, nesting, roosting, and foraging. Continuing to plant desired species would not result in significant adverse effects on wildlife species from disturbance, with adverse effects more likely to be negligible to minor when removing

nonnative plants and preparing a site for planting desired native species. It is unlikely that any wildlife would be permanently displaced.

The mixed-deciduous forests are in decline in the mid-Atlantic region. These forest types provide feeding, resting, breeding, and wintering habitat for a diversity of native forest-dwelling birds, mammals, reptiles, amphibians, and invertebrates. Fragmentation of forests also has been decreasing or degrading habitat for wildlife species, especially birds that dwell in the interior of forests, which are negatively impacted by increases in "edge." The actions taken by the NCTC to increase the amount of young and mature hardwood forests areas would benefit wildlife currently present and could eventually attract some of the priority/focal species whose populations are in decline. The conversion of some fields to diverse native forest communities (trees and shrubs) would initially provide early successional habitat preferred by some wildlife, such as the American woodcock, prairie warbler, whip-poor-will, field sparrow, eastern towhee, and blue-winged warbler. Most of the planned forest restoration actions would involve widening or connecting existing woodlands, creating more forest interior, and decreasing the amount of edge. Over the years, as the new forests mature, other bird species (such as the Cerulean warbler, wood thrush, Kentucky warbler, prothonotary warbler, Acadian flycatcher, and scarlet tanager) could be attracted to these areas.

Alternatives A and C—Direct and Indirect Effects from Activity 2: Continue Chemically Treating Undesirable Species

Vegetation. The continued use of herbicides would result in long-term minor to major beneficial effects on native vegetation because exotic (nonnative) invasive plants would be controlled or eradicated while minimizing impacts on native vegetation and creating conditions in which native plant populations can increase. Removing the invasive plants (either manually or chemically), particularly the hanging vines, would also reduce ground and ladder fuels. The implementation of the resource protection measures (refer to Table 4) would mitigate any potential adverse effects on nontarget plants to the negligible level.

Herbicides are used in the forest areas when manual (hand pulling) and mechanical (such as by weed trimmer, chainsaw, and brush cutter) methods are not effective or practical in controlling or removing nonnative plants. Herbicides are currently used to meet the goal of eliminating nonnative invasive plants. When properly applied, eradicating or reducing invasive plant populations using herbicides would result in beneficial effects on the native plant species because treatments would reduce competition for resources (sunlight, soil nutrients, and moisture) and promote diverse native forest plant communities. Controlling the invasive nonnative plants would enable re-establishment of native vegetation, either through natural regeneration or planting desired species (Action 1 above). Some of the same foliar herbicides (Accord, Escort, Milestone, Garlon 3A) used in NCTC grasslands are also applied to nonnative plants in forest areas, as is Garlon 4, which is applied as a basal bark treatment to individual stems. In addition, Sethoxydim E-Pro is used to control Japanese stiltgrass.

The primary adverse effect that could result is if herbicides were sprayed on susceptible nontarget vegetation. This could occur through drift, which the NCTC and National Park Service herbicide application crews avoid by spraying when the wind speed is less than 10 mph or using alternative application methods. Similar damage could occur when the nontarget species is intermingled with the target species. In that situation a selective product (one that does not affect certain nontarget species) may be used. A directed application may be used to prevent or reduce

application onto the nontarget plants, or if a certain amount of damage to common nontarget plants is acceptable. Other precautions are taken, such as creating herbicide-free buffers around sensitive areas and nontarget plants and shielding nontarget and sensitive plants with suitable material, such as a tree shelter, bucket, or other means (refer to Table 4 in Chapter 2). The proper use of herbicides would not result in more than negligible to minor adverse effects on nontarget plants in the short term and long-term minor to major beneficial effects on native vegetation as invasive exotic plants are controlled and eradicated.

Wildlife. The herbicides would pose either no risk or a slight risk to birds and no risk to mammals and insects; therefore, any adverse effects would be negligible or discountable. The implementation of the resource protection measures would mitigate any potential adverse effects to the negligible level. The herbicides that would be used in the forests include those listed above in the grasslands section, and the effects on wildlife from using the herbicides would be the same as described above under "Alternatives A and C—Direct and Indirect Effects of Grasslands Action 4: Continue Chemically Treating Undesirable Species" and in Appendix E. The one other herbicide that would be in used in forest areas would be Sethoxydim E-Pro.

- Sethoxydim E-Pro (active ingredient is sethoxydim). Sethoxydim is used post-emergence for selective control of annual and perennial grass weeds in broadleaf crops. Technical sethoxydim is practically nontoxic to mammals on an acute basis and no risks are expected for maximum label rates. It is practically nontoxic to birds on an acute basis. The screening level ecological risk assessment for endangered species resulted in a determination that sethoxydim results in no direct effects, either chronic or acute, on mammals, aquatic phase amphibians, mollusks, and marine/estuarine fish and crustaceans. There also are no direct acute effects on avian species, freshwater fish and crustaceans, and no direct effects on terrestrial and semi-aquatic dicots. A bee toxicity study indicted that sethoxydim technical is practically nontoxic to bees on an acute contact basis, which implies there is likely not a direct acute effect on insects.

Alternative C — Direct and Indirect Effects from Activity 3: Proposed Use of Prescribed Fire

Vegetation. The effects of prescribed fire would be beneficial in both the short and long term. The duration and degree of beneficial effects would be influenced by the frequency of the prescribed burns in forested areas and the number of acres burned at the NCTC in a given cycle.

The NCTC is proposing to use prescribed fire as a tool to remove nonnative plants in forest areas. Fire helps retard the growth of undesirable plants and promote native vegetation, improving the competitive advantage of the native species. For example, native forbs have greater seed production, germination, and establishment after a fire because burning allows plant nutrients to be returned to the soil and used again (NIFC 2010a, b). The productivity of native plant species usually increases following a fire, and growth is stimulated by burning leaf litter. Some seeds require mineral soil for germination, and fire can release nutrients in the soil and make them available for sprouting plants.

Plant recovery following a fire is fastest in spring and fall when soil moisture is high and plants are not producing seeds (NIFC 2010a, b). The elimination of nonnative invasive vegetation would reduce competition for resources (such as sun, soil nutrients, and moisture) needed by native plants. Minor to moderate beneficial effects could be realized within a year or two following prescribed burns as native plants begin to thrive and spread. Complete eradication of nonnative

vegetation in forest habitat would result in long-term moderate to major beneficial effects, but that may not be possible considering the level of human and financial resources that would be required.

The proposed use of prescribed fire in the forest areas is also provided as a fuel reduction treatment option in the event long-range weather predictions show considerably less-than-average precipitation and warmer-than-normal temperatures for an extended period of time. Prescribed fire would be used as a tool to reduce fuel loads, in addition to the use of manual and mechanical removal of fuels. Ground and ladder fuels would only be reduced if an abnormally dry spring, summer, and/or fall are predicted for the eastern United States. Prescribed burns to reduce fuels would occur as early as practical in late winter/early spring. (Fuels are anything within the forest that will burn; usually live and dead woody vegetation. Ground fuels include understory plants [up to 6 feet tall, both dead and alive], the litter layer, downed woody materials, and often mid-story tree and shrub fuels. Ladder fuels consist of shrubs or trees that connect ground fuels to the tree crowns.)

The potential for a prescribed fire to grow beyond the planned burn area would be minimal (thus adverse effects would be negligible to minor) when the burn is implemented according to the guidelines established in the required burn plan.

Wildlife. As with prescribed fire in grassland habitat, the effects on forest wildlife could be both adverse and beneficial. The improved habitat that would result from the use of prescribed burning would benefit wildlife. The prescribed burns in forests at the NCTC would not be large or intense enough to cause permanent displacement of wildlife, so adverse effects would be temporary and negligible to minor.

Fire removes dry, dead plant matter that has built up over the years, opening up space for new growth and creating thicker, younger cover and increasing food availability by stimulating seed production (USFWS 2010c). Birds and some mammals usually leave the area ahead of a fire (USFWS 2010c). Few animals would be unable to escape the fire, and small mammals, reptiles, and amphibians that inhabit the forests would find shelter by burrowing under a log or staying in an underground burrow. Adverse effects on wildlife would be minimized by planning spring burns early enough to avoid the breeding and nesting season of most wildlife and by implementing other resource protection measures listed in Table 4 (Chapter 2).

Alternatives A, B and C — Direct and Indirect Effects of Wildfire

Vegetation. The effects of a wildfire could be both beneficial or adverse in the short and long term, depending on other variables that affect fire behavior and characteristics such as topography, temperature, humidity, wind speed, and structure of the plant community and depending on what fuel reduction actions were conducted under Alternatives A and C prior to the wildfire. The beneficial effects would be similar to those described above for prescribed fire under Alternative C.

If no actions were taken to reduce fuel loads (as with Alternative B), a wildfire under the right meteorological conditions could potentially result in long-term minor to major adverse effects on forest vegetation.

Wildlife. The potential effects (both beneficial and adverse) of a wildfire on forest wildlife would be similar to those described above for prescribed fire in the mixed-deciduous forests under Alternative C.

Alternatives A and C—Cumulative Effects

The high deer population at the NCTC contributes to the occurrence and spread of invasive plant species by the transport of seeds on hooves and hide, disturbance of soils, and the killing or suppression of native plants. Continuing to monitor and control the white-tail deer population will limit the number of deer that browse on native vegetation and spread invasive plant seeds. Managing forest habitat in concert with controlling deer populations would result in long-term minor to major beneficial cumulative effects, commensurate with the level of management actions that are implemented in a given year and over time.

Alternative B—Direct and Indirect Effects

Ceasing all land management actions at the NCTC could have major long-term adverse effects as the native forest vegetation converts to nonnative invasive plant communities. Native plant populations would continue to shift toward a few species that are resistant to deer and can compete with exotic plants. Native wildlife adapted to native plants could be adversely affected.

In the absence of actions to reduce fuel levels, the effects of a wildfire could be both beneficial or adverse in the short and long terms, depending on the variables that can affect fire behavior such as topography, temperature, humidity, wind speed, and structure of the plant community.

Nonnative plants have become established and continue to be introduced to NCTC lands via birds; seeds that are carried by wind; seeds or plant parts that hitchhike on animals, people, vehicles, and equipment; or by water via the Potomac River. In the absence of any type of treatment to control invasive plants, they could out-compete and displace native plants and lead to changes in species composition, vegetation structure, and soil chemistry. Currently, in some areas at the NCTC, invasive plants have taken over to a degree that they have become the dominant vegetation—this would only worsen over time by not controlling invasive plants and replanting with native species. The lack of management could lead to monocultures (plants of only one species in a particular area) rather than an ecosystem that supports plant and animal diversity.

The replacement of native plants with nonnative plants would cause long-term adverse effects on the native insects, birds, and animals that are adapted to living and reproducing along with native plants. For example, native insects, birds, and animals sometimes readily feed or reproduce on nonnative plants, leading one to think this is beneficial. However, this can negatively affect their diet, lead to mortality or reproductive failure, make them vulnerable to pests and predators, or prevent the pollination or seed dispersal of native plants.

Alternative B—Cumulative Effects

Continuing to monitor and control the white-tail deer population on NCTC would benefit forest habitat by ensuring the deer do not over browse native vegetation that survive in the absence of any land management actions. Nonnative plant species would likely proliferate without any actions to minimize or eradicate them. As native plant species are overtaken by invasive nonnative species, wildlife may begin migrating in search of suitable habitat off NCTC property. Choosing Alternative B would result in minor to moderate adverse effects in the short term, but as time goes by, effects would shift to moderate to major if native habitats become dominated by nonnative plants that may be unusable for many wildlife species. Alternative B would not meet the NCTC objectives for mixed-deciduous forests.

3.2.4.7 Riparian/Wetland Areas: Existing Conditions

Vegetation

There are approximately 15 acres of riparian/wetland areas at the NCTC (see Map A-6).

Riparian Areas. The Potomac River and its relatively intact riparian edge serve as a natural dispersal and migration corridor between the Appalachian Mountains and the Atlantic Coastal Plain for migrant birds and many other species. The towpath of the C&O Canal National Historic Park on the opposite side of the river creates a conservation corridor more than 180 miles in length, allowing mammals such as bobcats, coyotes, and black bears to occasionally travel through the area.

The largest riparian community can be found along the relatively steep north-facing riverbank directly adjacent to the Potomac River. The plant community here is composed of species tolerant of the frequency and magnitude of Potomac River flood events. A close inspection reveals that the riverbank is "stepped" about halfway down. The "step" is referred to as the height of the bankfull channel, and it marks the height of the river when it is most efficient at moving sediment—this is also referred to as the channel-forming discharge. The area below the step and above the wetted perimeter is considered part of the active channel, which experiences fairly frequent flood events. The river reaches the height of the bankfull channel (the "step") on average about every 1.5 years. The broad flat bench south of the riverbank once used for crops is an old floodplain or bench, with flood frequency probabilities in the 10-year range for the lowest areas up to 50 years for the highest.

The most common trees in the Potomac riparian zone are primarily flood-tolerant species. Below the bankfull stage height, the most common species by far are boxelder (dominant in terms of numbers of individuals), silver maple, and sycamore. Above the bankfull discharge height, additional species include pawpaw, American elm, green ash, hackberry, and black walnut. The most common shrubs include spicebush and bladdernut. The common herbaceous plants are Virginia wild rye, bottlebrush-grass, wood nettle, jewelweed, and nonnative gill-o'er-the-ground and garlic mustard. Spring wildflowers include the nonnative star-of-Bethlehem and natives such as yellow trout lily, white trout lily, wild ginger, and Virginia bluebells.

Other riparian areas are found along the several small ponds (described below under "Wetland Areas") and small streams, most notably Springwood Creek. This spring-fed waterway typically flows year-round and begins as a pond (Springwood Pond) adjacent to the Hendrix property, and flows north to the Potomac River through a mostly forested corridor. Other than some black willows in one of the more open sections, the vegetation along Springwood Creek in the same as for other immature forest areas.

Wetland Areas. Wetlands produce enormous amounts of organic material and debris, which is directly linked with wildlife and fisheries productivity. This makes wetlands two to three times more productive than very fertile agricultural land. The abundant vegetation found in wetland areas supplies food and shelter to the many organisms found in that ecosystem (USGS 2010g).

Some wetlands at the NCTC are located in small pockets adjacent to the streams and the Potomac River, where topographic relief allows the water to spread out a few tens of feet to the side. The composition of native plant species tends to be high, although there are often just a few individuals of each species present. Some characteristic species include jewelweed, New York ironweed, ditch

stonecrop, rattlesnake mannagrass, rice cutgrass, and several species of carex and scirpus, as well as invasive species such as cattail, phragmites, reed canary grass, and barnyard grass, among others.

There are six ponds on the property that serve as other wetland areas; the six ponds are (1) Springwood Pond (a spring-fed pond adjacent to the Hendrix property); (2) West Pond (across Baird Drive from the Day Care Center); (3) Central Pond (beside the Blue Lot); (5) South Pond (in the forest near Support Services); (5) East Pond (near the Central Plant); and (6) Ding Pond. Ponds 2 – 6 were created for storm water management and hold water to varying degrees, except for Ding Pond, which is currently not holding water due to a sink hole (refer to Map A-6).

Phragmites is one of the problematic species that will probably require periodic re-treatment. This species had once nearly taken over the West Pond but is currently controlled. Phragmites is a vigorously growing species of reed that, once introduced, can establish and take over a wetland, becoming a monoculture within several years (NPS 2008). Phragmites is not locally native and is primarily found on the coastal plain of the eastern United States. An aggressive exotic (North African) genetic strain has also been introduced and has become a problem locally. Phragmites stands are typically dense and impenetrable, and except for the stand edge, are of little value to nesting waterfowl (USFWS 2007). Also, phragmites is very combustible. It is not an important wildlife food, but occasionally, seeds are eaten by waterfowl and rhizomes and stems are eaten by muskrats (USFWS 2007). An objective for phragmites control is to eliminate the nonnative variety whenever found, but not necessarily to completely eradicate the U.S. native variety of the species because it does contribute to overall habitat diversity of wetlands. Rather, the objective is to reduce the extent of monotypic stands that have invaded the ponds. The phragmites should be considered a management problem when they occupy more than 10 percent of total wet acres (USFWS 2007), which was the case for the West Pond.

Cattails, also combustible when dormant, have taken over the East Pond near the gym, which has dried up, at least partly due to the mass of cattail present. While a native species, cattail spreads readily by wind-dispersed seeds and by roots. It is a vigorous grower and can quickly dominate an area, crowding out wetland plants that have greater wildlife value and forming a dense monoculture. As with phragmites, small populations of cattail should be considered acceptable, though it should be controlled once it starts to spread. Cattail repopulates so quickly that there is no concern that it will be extirpated. Once a long-term plan for the East Pond is developed, it may require total control of the existing cattail and replacement with other, more desirable wetland vegetation.

Wildlife

Wetlands are known for their incredible biodiversity. The priority/focal species listed for riparian/wetland habitat at the NCTC include the American black duck, green heron, American bittern, bank swallow, upland chorus frog, Eastern ribbon snake, starnose mole, bald eagle, and wood turtle (refer to Appendix B for a detailed list of species). Appendix B also contains a list of fish common to the NCTC section of the Potomac River.

The NCTC property contains significant natural features as defined by the West Virginia Natural Heritage Program. The significant natural features on the site include limestone cliffs, the floodplain of the Potomac River, caves, and mesic limestone forests. These significant natural features are discussed below in section 3.3.

3.2.4.8 Riparian/Wetland Areas: Desired Conditions

It is hoped that the planting and natural regeneration of native and desirable wetland plants will eventually have created a natural wetland habitat area in and around the five storm water management ponds and one spring-fed pond. A swath of vegetation is well established along or around each waterway or wetland, in a gradient from wetland to upland plant species, a minimum of 15 feet wide (except trails, dams, and structures). These areas are providing habitat for a diversity of wildlife species. Invasive nonnative plants have been eradicated or reduced from the riparian/wetland areas. The stream banks and associated wetland areas are being protected by allowing only limited use by NCTC staff and visitors, and no recreational use (except occasional recreational fishing and walking along the bank of the Potomac River) is allowed in those areas.

3.2.4.9 Riparian/Wetland Areas: Environmental Consequences

Alternatives A and C—Direct and Indirect Effects from Activity 1: Continue to Re-establish Desired Species

Vegetation. Alternatives A and C would produce short-term beneficial effects that may range from minor to moderate, depending on the amount of desired plants that can be reestablished or maintained each year, and moderate to major long-term beneficial effects if vegetation is continually managed.

The types of plant species growing in a wetland are often a gauge of the wetland's biological status. Vegetation has been frequently used as an indicator of wetland restoration (or maintenance) success, and a wetland's ability to support its natural vegetation can be a positive indicator of its capability to sustain natural functions and biological processes (Book and Rokosch 2000). Kentula (2000) assumes that success can be positioned in different ways. Functional success is determined by evaluating whether the ecological functions of the system have been restored or are being maintained. Landscape success is a measure of how restoration (or management, in general) has contributed to the ecological integrity of the landscape and to achievement of objectives, such as maintenance of biodiversity. Actively managing vegetation in wetlands and riparian areas and re-establishing (either through planting, seeding, or natural colonization) desired species would not result in adverse effects.

Wildlife. Long-term beneficial minor to major effects would persist as management actions continue to maintain and restore healthy, diverse habitat in the riparian/wetland areas and as the newly established vegetation provides more and higher-quality habitat. Continuing to plant desired species would produce both short- and long-term beneficial effects on wildlife species that depend on native vegetation for breeding, nesting, roosting, and foraging. Adverse effects on wildlife from site preparation activities prior to planting would likely be minimal and temporary.

Wetlands are a key habitat for many birds, reptiles, amphibians, and mammals that depend on their ecological structure, composition, and function. Continuing to propagate desired plant species would benefit wildlife by increasing the availability and quality of wetland habitat. Any adverse effects on wildlife would only be temporary and negligible to minor because some wildlife may leave an area when planting activities are occurring, and some species may not be bothered.

Alternatives A and C—Direct and Indirect Effects from Activity 2: Continue Chemically Treating Undesirable Species

Vegetation. The continued use of herbicides would result in long-term minor to major beneficial effects on native vegetation because nonnative invasive plants would be controlled or eradicated.

Herbicides are used near riparian/wetland areas when manual (hand pulling) and mechanical (such as a weed trimmer, chainsaw, and brush cutter) methods are not effective in controlling or removing nonnative plants. Eradicating invasive plants using herbicides would result in beneficial effects on the native wetland plants because treatments would reduce competition for resources (such as sunlight, soil nutrients, and moisture) and promote growth of both existing native plants and the desired species that were planted under Action 1 above. Accord Concentrate is currently used in wetland/riparian sites at the NCTC, and one that may be used on such sites is Garlon 3A. Both of these products are approved by the EPA for use in wetland and aquatic sites. Garlon 4 Ultra might be used on the stems of certain invasive trees and shrubs in dry sections of riparian areas.

Adverse effects can occur if an herbicide is inadvertently sprayed on nontarget vegetation through drift, which the NCTC and National Park Service herbicide application crews avoid by only spraying when the wind speed is less than 10 mph. Other precautions are taken, such as creating herbicide-free buffers around sensitive areas and nontarget plants and shielding nontarget and sensitive plants or other means (refer to Table 4 in Chapter 2). The proper use of herbicides will minimize the potential for adverse effects on nontarget plants. There would be long-term minor to major beneficial effects on native vegetation as invasive exotic plants are controlled and eradicated.

There is the potential for a priority/focal plant species (such as spreading sedge) to occur in the riparian/wetland areas (refer to Table 6). Pre-treatment field reviews and implementation of resource protection measures (refer to Table 4) will serve to protect this plant if it is observed at the NCTC.

Wildlife. The herbicides pose either no risk or a slight risk to birds and no risk to mammals and insects; therefore, any adverse effects would be negligible or discountable Potential adverse effects on freshwater invertebrates would be mitigated to negligible by the implementation of resource protection measures.

The effects on birds, mammals, fish, invertebrates, freshwater fish, and freshwater invertebrates from herbicides that are currently used or would be used in the future are discussed above under "Alternatives A and C—Direct and Indirect Effects of Grassland Action 2: Continue Chemically Treating Undesirable Species." Care must be taken when using Garlon 4 Ultra in wetland and riparian areas because it is moderately to highly toxic to freshwater fish and slightly to moderately toxic to freshwater invertebrates. Garlon 4 Ultra is only slightly toxic to birds. As stated earlier, Garlon 4 Ultra is not used as a foliar spray but is only applied directly onto the trunk of a target tree or shrub. It is also applied in a manner that prevents application onto water or in a location that might allow runoff to a wetland or waterway.

Alternatives A, B, and C—Direct and Indirect Effects of Wildfire

Vegetation and Wildlife. During periods of average temperatures and precipitation, the potential for a wildfire in the wetland/riparian areas would be low. If a fire were to start, adverse effects would be negligible to minor. Wildfire danger would increase during periods of higher-than-

normal temperatures and lower-than-normal humidity levels. In that situation, adverse effects of a wildfire under Alternative A, B or C would be minor to moderate on vegetation and wildlife.

Alternatives A and C—Cumulative Effects

Managing wetland/riparian habitat in concert with controlling the deer population would result in long-term minor to major beneficial cumulative effects, commensurate with the level of management actions that are implemented in a given year and over time.

The high deer population at the NCTC contributes to the occurrence and spread of invasive plant species by the transport of seeds on hooves and hide, disturbance of soils, and the killing or suppression of native plants. Continuing to monitor and control the white-tail deer population will limit the number of deer that browse on native vegetation and spread invasive plant seeds.

Alternative B—Direct and Indirect Effects

Vegetation. Ceasing all land management actions at the NCTC could have major long-term adverse effects as the desirable riparian/wetland vegetation converts to nonnative invasive plant communities.

Alternative B would not meet management objectives because it would not contribute to the creation of new riparian/wetland habitat at the NCTC or maintenance of current habitat. Over time, the lack of management would allow undesirable plants to persist and spread, displacing native riparian/wetland vegetation. Some nonnative vegetation, such as reed canary grass, form dense stands capable of excluding virtually all other plant species (USGS 2010g). When this occurs, the habitat converts to a monoculture, which does not provide the habitat diversity needed to support and attract a variety of wetland-dependent wildlife species.

Wildlife. Ceasing all land management actions at the NCTC could have major long-term adverse effects as the desirable riparian/wetland vegetation converts to nonnative invasive plant communities. Ceasing all land management actions could lead to the potential loss of any wetland areas, resulting in local minor to major long-term adverse effects on wildlife if no management actions were taken to control invasive vegetation.

The lack of management actions to protect and maintain the riparian/wetland areas would degrade the function and value of that important habitat, particularly for the many species of wildlife whose entire life cycle depends on wetlands. The primary concern for wetland wildlife is the conservation and management of wetlands—of all sizes, including small ones, such as those found at the NCTC. The loss of any wetland affects bird species, such as the green heron and American black duck, and reptiles and amphibians, such as the wood turtle, upland chorus frog, and eastern ribbon snake—all priority/focal species (see Appendix B). Phragmites, cattails, and other invasive species can contribute to dehydration of ponds, and changes in wetland water levels can alter the quantity and quality of habitat, especially for reptiles and amphibians. This could trigger immigration, emigration, and breeding of particular species and their predators (USGS 2010g). The effects of dehydration may be particularly severe if dehydration occurs during reptile and amphibian hibernation, due to the effects of exposure and increased predation of eggs (USGS 2010g).

Alternative B—Cumulative Effects

Continuing to monitor and control the white-tail deer population at the NCTC would benefit riparian/wetland areas by ensuring the deer do not over browse native vegetation that survive in the absence of any land management actions. Nonnative plant species would likely proliferate without any actions to minimize or eradicate them. As native plant species are overtaken by invasive nonnative species, wildlife may begin to decline or migrate in search of suitable habitat off NCTC property. Choosing Alternative B would result in minor to moderate adverse cumulative effects in the short term, but as time goes by, effects would shift to moderate to major as native habitats are converted to monocultures of nonnative vegetation.

All Habitat Areas

The bald eagle and wood turtle are two species that are or may be present in all habitat areas at the NCTC. The species accounts are presented in Appendix B, but effects from land management activities on vegetative communities are discussed under the effects discussion above for each habitat type; that is, grasslands, mixed-deciduous forests, and riparian/wetlands. A specific resource protection measure for the bald eagles nesting at the NCTC is included in Table 4.

3.2.4.10 Alternative C: Controlling Other Pests

Control is warranted due to the many environmental and human health problems that are caused by pests. Pests include insects, diseases, weeds, rodents, nonnative animals, and similar organisms that harm or threaten to harm vegetation, animals, and other native biota or that pose a risk to facilities or human health. The pests are mostly nonnative ones, although native organisms may also need to be controlled in certain situations. The particular species that may require chemical treatment are hemlock wooly adelgid, emerald ash borer, gypsy moth, German cockroach, mosquitoes, deer tick, house mouse, Norway and black rats, and poison ivy, among others.

This section discusses pests that affect both the biological environment and human health. Many of the diseases that affect humans are transmitted by insects and animals, so it is sensible to discuss them together in this section.

The following are examples of the pests that could create the greatest adverse effects in the forests and landscaped areas at the NCTC.

- *Hemlock wooly adelgid*—hemlock woolly adelgid is a fluid-feeding insect that feeds on hemlock trees throughout eastern North America. The egg sacs of these insects look like the tips of cotton swabs clinging to the undersides of hemlock branches. The adelgid sucks fluid from the base of hemlock needles. It may also inject toxins into the tree as it feeds, accelerating needle drop and branch dieback. Although some trees die within four years, trees often persist in a weakened state for many years. Hemlocks that have been affected by hemlock woolly adelgid often have a grayish-green appearance (hemlocks naturally have a shiny, dark green color). Moderate hemlock woolly adelgid populations may cause a reduction in tree health. Severe infestations may result in premature needle drop, reduced twig growth, dieback, or death of trees (PSU 2010). Forty-seven species of mammals and 96 species of birds have been documented using the hemlock resource in the northeastern United States (Degraff et al. 1992 *in* WVDA 2010a). The hemlocks at the NCTC are plantings in landscaped areas.

- *Emerald ash borer*—an exotic beetle that probably arrived in the United States on solid wood packing material carried in cargo ships or airplanes originating in its native Asia. The adult beetles nibble on ash foliage but cause little damage. The larvae (the immature stage) feed on the inner bark of ash trees, disrupting the tree's ability to transport water and nutrients. The emerald ash borer was found in Fayette County, West Virginia, in 2007 and Morgan County, West Virginia in 2009. It has killed tens of millions of trees in Illinois, Indiana, Kentucky, Minnesota, Missouri, New York, Ohio, Ontario, Pennsylvania, Quebec, Virginia, West Virginia, and Wisconsin.

- *Gypsy moth*—the most serious insect pest ever to invade West Virginia's forests. The first adult male gypsy moths were trapped in West Virginia in 1972, and the first caterpillars were found in 1978. The repeated heavy defoliation (stripping trees and plants of their leaves) by gypsy moths kills trees. Spruce, pine, and hemlocks die after a single heavy defoliation. Hardwood tree mortality, after two successive years of defoliation, can reach as high as 80 percent. The forest trees preferred by this insect are oaks, and the oak-hickory type makes up about 77 percent of West Virginia's woodlands (WVDA 2010). Much of the forest of NCTC is vulnerable to gypsy moth, especially the oldest and most ecologically important areas.

- *Feral cats*—typically, the wild offspring of a domestic cat, or a domestic housecat that was abandoned and over time has become unsocialized and extremely fearful of humans. Feral cats are a problem in West Virginia. They create a risk not only to birds, but to other native species, including small mammals, reptiles, amphibians, and insects. The periodic control of feral cats may be required to minimize damage to bird and small mammal populations. They are caught unharmed by hand or in cage traps. Kittens and tame cats are adopted, but wilder cats are euthanized by a local veterinarian.

The following are some examples of how pests affect human health.

- *German cockroach*—a widely distributed urban pest. Disease-producing organisms, such as bacteria, protozoans, and viruses, have been found on cockroach bodies. Different forms of gastroenteritis (food poisoning, dysentery, diarrhea, and other illnesses) appear to be the principal diseases transmitted by German cockroaches (PSU 2010).

- *Mosquitoes*—once infected, they transmit the West Nile [encephalitis] virus. The mosquitoes usually bite and infect wild birds—the primary host of the virus—but can also infect horses and other mammals, in addition to humans (PSU 2010).

- *Ticks*—the ticks infected with *Borrelia burgdorferi* transmit Lyme disease. The tick most commonly associated with the disease in the northeast is the blacklegged tick (*Ixodes scapularis*). Tick larvae and nymphs typically become infected with Lyme disease bacteria when they feed on infected small animals, particularly the white-footed mouse. Infected nymphs and adult ticks then bite and transmit Lyme disease bacteria to other small rodents, other animals, and humans (PSU 2010).

Alternatives A and B—Direct and Indirect Effects

Alternatives A and B would result in negligible to minor adverse effects on native vegetation in the short term because no measures would be taken to monitor and protect trees from hemlock wooly adelgid, emerald ash borer, gypsy moth, or other risks. As time goes by, effects would shift from minor to even major if the insects and diseases begin killing large numbers of trees at the NCTC.

Alternatives A and B would not protect NCTC staff and visitors from potential environmental and human health problems caused by pests (such as mosquitoes, cockroaches, and ticks) and the diseases they carry. Cleanliness and proper sanitation are a high priority at the NCTC, so currently, there are no significant problems with these pests, but a situation that is harmless now, could turn into an important issue without the option to control the pests if needed.

Alternatives A and B—Cumulative Effects

Alternatives A and B, in concert with continuing to monitor and control the white-tail deer population on NCTC, would not result in any adverse cumulative effects.

Alternative C—Direct and Indirect Effects

Controlling the many types of pests would result in beneficial effects on human health, native vegetation, and wildlife. Treatments would be beneficial because they would serve to prevent unacceptable damage or impediment to forests, grasslands, riparian areas, habitat restoration sites, landscaped areas, roads, sidewalks, trails, fences, buildings, and other facilities.

Invasive plants interfere with the use and maintenance of landscape beds, sidewalks, trails, and fences. The cultural controls (selection of plants, removal or pruning of infested or diseased plants, vegetation management, and preventing access or similar means) would not result in adverse effects on wildlife or native vegetation. The beneficial effects include a more aesthetically pleasing and more accessible area for educational, recreational, or maintenance activities.

The mechanical control (collection, trapping, or otherwise physical removal) of pests would not result in adverse effects on wildlife. The treatments would, however, serve to protect birds and small mammals that commonly fall prey to feral cats. The host plant, animal, or facility would be protected from infestation, disease, or other ill-effects.

Some insects, diseases, rodents, and similar organisms may require chemical treatment to suppress or control. Any adverse effects of using chemical controls (such as insecticides, fungicides, herbicides, rodenticides, and similar chemicals) would be mitigated through implementation of resource protection measures listed in Table 4. The chemicals will be used according to the Pesticide Use Proposal, IPM plan, and in compliance with all federal and state regulations. The following is a brief summary of potential effects from the proposed pesticides (see Appendix E for additional information and website addresses to view fact sheets and detailed information for the products). None of the proposed products would have short- or long-term adverse effects on mammals or avian species, but could have major adverse effects on fish and other aquatic organisms. The products' toxicity is identified below and in Appendix E.

Herbicides

- Accord Concentrate. See the discussion above under the effects on wildlife in grassland areas.

- Pendulum AquaCap (active ingredient is pendimethalin). It would be used at the NCTC for protection of tree seedlings in forest restoration areas from weed competition and for weed prevention in landscape areas. Pendimethalin does not represent a high acute risk to birds or a high acute or chronic risk to mammals. Because pendimethalin is highly toxic to fish and aquatic invertebrates, drift and runoff from treated areas may be hazardous to fish and other aquatic organisms.
- SureGuard (active ingredient is flumioxazin). It would be used at the NCTC for weed prevention in ornamental and landscape areas. The data available at this time indicate that flumioxazin is highly toxic to target and nontarget plants. It is also toxic to aquatic invertebrates and should not be applied to water or in areas where surface water runoff is possible. It is unlikely that flumioxazin will pose a risk of acute or chronic toxicity to nontarget animals.

Insecticides

- Horticultural Oils. The oils would be used at the NCTC to control a wide range of insects and mites such as scale insects, hemlock wooly adelgid, aphids, sawfly, leafminer, and spider mites in landscape and reforestation sites. Toxicity is minimal, and oils quickly dissipate through evaporation, leaving little residue. Oils pose few risks to people.
- Insecticidal soap. Insecticidal soap would be used at the NCTC to control a wide variety of insects and mites such scale insects, sawfly larvae, aphids, and spider mites in landscape and reforestation sites. The soaps have low toxicity to mammals.
- Neem Oil. Neem oil would be used at the NCTC to control scale insects, spider mites, leaf-roller, and other insects in landscape and reforestation sites. Neem oil is not toxic to mammals or birds, but it is toxic to fish and invertebrates.
- Dipel. *Bacillus thuringiensis* (BT) is a biological insecticide that might be used at the NCTC to control gypsy moths, bagworms, webworms, and other caterpillar pests in landscape and reforestation sites, and if necessary, to control of gypsy moths in woodlands. BT is essentially nontoxic to people and wildlife. Its high margin of safety allows for its use on food crops or in other sensitive sites where use of other pesticides could cause adverse effects.
- Pyrethrin (active ingredient is pyrethrin). Pyrethrin would be used at the NCTC to control beetles, ahpids, bagworms, mosquitoes, ticks, stink bugs, shoot moths, webworms, cockroaches, wasps, hornets, yellow-jackets, and black widow spiders in indoor and outdoor areas landscape and reforestation sites. The EPA did not find acute or chronic risk for listed or nonlisted mammals and birds. Pyrethrins are highly toxic to fish and other aquatic organisms and highly toxic to bees. Because the pyrethrins can accumulate in sediments, risk to sediment-dwelling organisms is an area of particular concern.
- Conserve (active ingredient is spinosad). Spinosad would be used at the NCTC to control lepidopterous and sawfly larvae and other insects in landscape, reforestation, and forest areas. There are no acute or chronic levels of concern exceeded for birds, terrestrial, and freshwater aquatic organisms or acute levels of concern for estuarine organisms.
- Merit 2F (active ingredient is imidacloprid). It would be used at the NCTC to control emerald ash borer, hemlock wooly adelgid, Ips beetles, and other insects and mites. Imidacloprid is toxic to upland game birds and highly toxic to bees, especially if used as a foliar application. Imidacloprid is highly toxic to aquatic organisms. Studies in rats and rabbits show no skin irritation and minimal irritation to eyes.

- Talstar (active ingredient is bifenthrin). It would be used at the NCTC to control such pests as ants, ticks, termites, stink bugs, wasps, hornets, mosquitoes, and other insects around buildings, recreation sites, and in landscaped areas. Refer to "Pyrethrin" above for toxicity.

Fungicides

- Lime-sulfur (an inorganic polysulfide). It would be used at the NCTC to prevent or control plant diseases such as anthracnose, black spot, powdery mildew, and scale insects. Lime-sulfur poses no risks that require mitigation. The EPA waived all environmental fate data requirements for sulfur in 1982, based on the fact that it is a natural component of the environment. The risks associated with exposure to sulfur appear to be low.
- Daconil (active ingredient is chlorothalonil). It would be used at the NCTC to prevent fungus diseases such as a dogwood discula, sycamore anthracnose, leaf spot, and powdery mildew in landscape and reforestation areas. This product is highly toxic to aquatic invertebrates and aquatic wildlife. Chlorothalonil is practically nontoxic to avian species and small mammals on an acute oral and subacute dietary basis. The bioaccumulation potential of chlorothalonil is low.

Rodenticides

- Rodex Pelleted Bait (active ingredient is warfarin). Warfarin works by preventing blood coagulation, leading to death of the rodent, typically several days after ingestion. Warfarin is also prescribed as a blood thinner for people with circulatory concerns. It would be used at the NCTC to control rats or mice near structures. Rodenticides applied as bait products can pose risks to wildlife from primary exposure (direct consumption of rodenticide bait) and secondary exposure (predators or scavengers consuming prey with rodenticides present in body tissues). The EPA requires that all rodenticide bait products available for sale to consumers be used only in tamper-resistant bait stations.
- ERAZE Rodent Pellets (active ingredient is zinc phosphide). This product is a non-anticoagulant that works by producing a toxic gas when it contacts the stomach acid of rodents that ingest it. It would be used at the NCTC to control rats or mice near structures, and only used in tamper-resistant bait stations. It works quickly and is used on rodent populations that have developed resistance to warfarin or in rotation with that product to keep resistance from developing. The EPA has determined that zinc phosphide is highly toxic to avian species on an acute oral and on a subacute dietary basis. The results from studies indicate that zinc phosphide is highly to very highly toxic to small mammals on an acute oral basis and to fish. This product should not be applied directly to water or to areas where surface water is present. Zinc phosphide and its residues appear to be nonpersistent under most environmental conditions and relatively immobile (zinc ions and dissolved phosphorus readily sorb onto soil).

Alternative C—Cumulative Effects

High deer populations can contribute to the occurrence and spread of invasive plant species by the transport of seeds on hooves and hide, disturbance of soils, and the killing or suppression of native plants. Continuing to monitor and control the white-tail deer population at the NCTC will limit the number of deer that browse on native vegetation, spread invasive plant seeds, and provide a host and vector of ticks and tick-borne diseases. The implementation of actions to control pests throughout the NCTC, in concert with controlling deer populations, would result in long-term minor to major beneficial cumulative effects, commensurate with the level of control measures that are implemented in a given year and over time.

Any time one part of the NCTC ecosystem (whether it be forest, wetland, or developed area) fails, there is usually an impact on other resources. For example, preventing the decline and mortality of trees and other plants results in savings for removal; that is, a large tree in a developed area may cost thousands of dollars and impact surrounding vegetation and the organisms that occupied that tree, as well as the resources expended to replace any plants that died. Damage to facilities from rodents, boring insects, and other pests may be costly and prevent the effective delivery of conservation education and other key services.

3.3 Significant Natural Features and Related Plant and Wildlife Species

3.3.1 Introduction

There are approximately 430 acres outside the core campus area that are managed primarily as wildlife habitat. The majority of the habitats (grasslands, mix-deciduous forests, riparian/wetland areas) were discussed above in section 3.2. The NCTC site contains significant natural features (as defined by the West Virginia Natural Heritage Program) that consist of other types of habitat. Those features are moss-covered limestone cliffs, floodplain of the Potomac River, caves, and mesic limestone forests.

3.3.2 Methodology

3.3.2.1 Analysis Methods and Assumptions

Priority/Focal Plant Species

The FWS methodology for appointing priority/focal wildlife and plant species were addressed in detail in section 3.2.3 above.

Listed Plant Species

The West Virginia Natural Heritage Program of the Division of Natural Resources has published guidelines for conserving significant natural features in Jefferson County and Appendix B lists rare, threatened, and endangered species known to occur in the county, many of which are species of concern in the state. However, because West Virginia has no official state regulations protecting sensitive species, the only species afforded protection in the state are those that are federally listed as threatened or endangered under the *Endangered Species Act*. There are no federally listed plants on NCTC lands. The Natural Heritage Program of the Division of Natural Resources has records of three species of plants occurring at NCTC that are considered uncommon or *rare*, including two species of rockcress (genus Arabis) and the white trout lily (or fawnlily). Two orchids that are considered *rare* in West Virginia can occur in the mesic forest areas, though they are not known to occur at the NCTC. These orchids are spring coralroot (*Corallorhiza wisteria*) and October (or oval) ladies'-tresses (*Spiranthes ovalis* var. *erostellata*) (WVDNR 2007).

3.3.2.2 Scope of the Analysis

Analysis Area. Management actions can have localized effects on plant attributes that are generally confined to the treated area. Therefore, the direct, indirect, and cumulative effects analyses for plants are geographically bounded to the lands within the NCTC.

Analysis Period. The timeframe for the effects analysis is 2 years for short-term effects and up to 15 years for long-term effects on vegetation.

3.3.2.3 Intensity of Effects

"Intensity" refers to the severity of effects or the degree to which the action may adversely or beneficially affect a resource. The intensity definitions used throughout this analysis are described below.

No Effect. The appropriate conclusion when it has been determined an alternative would not affect a resource, value, or process.

Negligible or Discountable. Effects would be at the lowest levels of detection and would have no appreciable effect on resources, values, or processes.

Minor. Effects would be perceptible but slight and localized.

Moderate. Effects would be readily apparent and widespread and would result in a noticeable change to resources, values, or processes.

Major. Effects would be readily apparent and widespread and would result in a substantial alteration or loss of resources, values, or processes and would likely be permanent.

3.3.3 Affected Environment (Existing Conditions) and Environmental Consequences: Significant Natural Features and Related Plant and Wildlife Species

3.3.3.1 Limestone Cliffs: Existing Conditions

The Shenandoah Valley is one of the major areas of surficial limestone in the region. The limestone and Phyllite riverside rock outcrops and cliffs support plant species seldom found elsewhere in West Virginia. Among these is the rare spreading rockcress, a priority/focal plant. The NCTC has the potential to conserve approximately one-quarter mile of these rock outcrops and cliffs along the Potomac River. Invasive exotic plants, most noticeably garlic mustard, Japanese stiltgrass, and tree-of-heaven have gained a foothold in this area and may impact the rockcress and other herbaceous plants. While these species can invade and spread slowly through relatively pristine forests, they are much worse in areas that have been disturbed—either by soil disturbance or opening of the vegetative canopy, allowing an increase in sunlight. Soil disturbance can come from human or animal activities, floods, or trees uprooted in storms. Canopy openings may come from human activities, storm damage, or insect or disease infestation.

3.3.3.2 Floodplains of the Potomac River: Existing Conditions

The floodplain of the Potomac River, a portion of which is included at the NCTC, is considered a significant natural feature because it can provide food and habitat for a number of species of special concern in Jefferson County, including the redbelly turtle (northern red-bellied cooter), the wood turtle, the evening (snowy) campion *(Silene nivea)*, giant cane *(Arundinaria gigantea* ssp. *gigantean)*, and the prothonotary warbler (WVDNR 2007). Of these species, the wood turtle and prothonotary warbler are considered priority/focal species listed above in Table 5 and included in Appendix B. While irregular and unpredictable, as a generalization the Potomac River typically experiences minor floods every few years, with major flooding every 10 to 15 years. These floods cause significant disturbance as they expose, wash away, or deposit soil, rocks, trees, and debris. They also create canopy openings and transport invasive plants via seeds and roots. A variety of invasive exotic plants are found on these disturbed areas, including Japanese hop, stinging nettle, Japanese stiltgrass, garlic mustard, and ground ivy.

3.3.3.3 Limestone Cliffs and Floodplains of the Potomac River: Environmental Consequences

Alternatives A and C — Direct, Indirect, and Cumulative Effects

There would be no or minimal adverse effects on the limestone cliffs from the manual cutting, pulling, or digging to remove invasive nonnative plants since care would be used to minimize disturbance. There would also be no adverse effects from herbicides because they would be applied in a targeted manner, such as individual plant treatments and would avoid native plants (such as the rockcress). Highly selective products would be used or application made during periods when the nontarget plants are dormant.

The primary land management activity that may occur in the vicinity of the limestone cliffs and floodplain under Alternatives A and C would be control of invasive exotic plants that may threaten the desirable native plants. The preferred methods of controlling invasive plants in these sensitive areas are manual cutting, pulling, or digging by a few trained people, though if not properly managed this activity may also create soil disturbance favoring the invaders. Herbicide application may be used in a targeted manner, such as individual plant treatments, avoidance of native plants (such as the rockcress), use of highly selective products, and application during periods when the nontarget plants are dormant. Similarly, in the event of a major outbreak of a forest pest that could kill many of the overstory trees, insecticides or similar products may be applied as part of an integrated pest management approach after investigation of potential impacts on native plants and animals.

Alternative B — Direct, Indirect, and Cumulative Effects

No land management activities would occur in the vicinity of the limestone cliffs, so there would be no potential for adversely affecting wildlife or the spreading rockcress.

Conversely, with no management actions occurring, invasive plants would likely proliferate in the floodplain and also increase in the limestone cliff area. Forest pests could kill large numbers of canopy trees, which would be directly harmful to the forest and indirectly create conditions that favor invading plants. Both of these problems would be damaging to the ecology of the cliff area, resulting in long-term minor to major adverse effects.

3.3.3.4 Cave Habitat: Existing Conditions

The cave habitat that occurs at the NCTC includes sinkholes and a small subterranean opening. This habitat type is important because it can provide habitat for cave invertebrates. Two cave invertebrates are of special concern (listed as rare by the West Virginia Natural Heritage Program; 2007) in Jefferson County — those are the Shenandoah Valley cave amphipod (*Stygobromus gracilipes*) and the Madison cave isopod (*Antrolana lira*). The Madison cave isopod is also a federally threatened species, and the U.S. Fish and Wildlife Services Species Profile (USFWS 2011) indicates the Madison cave isopod is known to occur or believed to occur near the Shenandoah River in Jefferson County. In general, it inhabits underground lakes and deep karst aquifers where it lives in the groundwater. It has been observed in a few caves that descend to the groundwater table. At the time of its listing in 1982, the Madison cave isopod was only known to occur in the Shenandoah Valley of Virginia. It is currently known to occur at two sites in West Virginia: one site is a cave that intersects groundwater and the other site is a well. Two other cave invertebrates, the Shenandoah

Valley cave isopod (*Caecidotea pricei*) and Blake millipede (*Conotvla blakei*), are not listed by the West Virginia Natural Heritage Program (as of the most recent list [2007]).

One bat species, the Indiana bat (*Myotis sodalis*), is listed as extremely rare and critically imperiled on the West Virginia Natural Heritage Program's most current list dated 2007. It was first federally listed as endangered in 1967. The bat is not known to occur in Jefferson County (USFWS 2010a). The bat hibernates during winter in caves and abandoned mines, then migrates to summer roosts, which are generally edges of hardwood forests (FR 1976). Because there is available habitat at the NCTC, there is potential for the Indiana bat to use NCTC's mixed-deciduous forests during the spring and summer (USFWS, B. Douglas, email to P. Pannill, January 20, 2011). The resource protection measures for the Indiana bat are included in Table 4 (Chapter 2).

3.3.3.5 Cave Habitat: Environmental Consequences

All Alternatives—Direct, Indirect, and Cumulative Effects

No land management activities would occur in the vicinity of the caves, so there would be no potential for adversely affecting the Shenandoah Valley cave amphipod, Madison cave isopod, Shenandoah Valley cave isopod, Blake millipede, and Indiana bat.

3.3.3.6 Mesic Limestone Forests: Existing Conditions

Mesic limestone forests occur at the NCTC site and are also considered to be a significant natural features because less than 10 percent of the original mesic limestone forest remains in Jefferson County. The West Virginia Natural Heritage Program considers the total forested acreage and the patchiness of small woodlots in Jefferson County to be below that required to prevent a severe decline in the native species associated with mesic limestone forests. Mesic limestone forests are rich woodlands located on limestone soils. These forests are one of the most diverse and productive forests in the state and are characterized by multiple strata, a mixture of hardwood trees in the canopy, and a lush vernal herbaceous layer. Two orchids that are considered rare in West Virginia can occur in this forest type, though they are not known to occur at the NCTC; they are the spring coralroot (*Corallorhiza wisteria*) and October (or oval) ladies'-tresses (*Spiranthes ovalis* var. *erostellata*) (WVDNR 2007). Major threats to the flora of these rich mesic forests is that of invasive exotic plants. Native herbaceous plants, in particular, are susceptible to species such as garlic mustard, Japanese honeysuckle, and Japanese stiltgrass.

3.3.3.7 Mesic Limestone Forests: Environmental Consequences

All Alternatives—Direct, Indirect, and Cumulative Effects

There would be no adverse effects on the two orchid species because resource protection measures would be implemented to identify, buffer, and protect the plants (refer to Table 4 for the resource protection measures for the two orchids).

Alternatives A and C would allow for control of invasive plants with herbicides, the most practical means in the large amount of heavily infested forest at the NCTC. There would be no control of invasive plants under Alternative B. Alternative C would allow for control of forest pests that could destroy overstory trees, allowing more light and growth of invasive plants. Alternatives A or B do not propose control of forest pests.

Under Alternatives A and C, a wildfire in mesic (moderately moist) forest areas at the NCTC could result in short-term adverse effects on vegetation that could range from negligible to minor, depending on variables that can affect fire behavior such as topography, temperature, humidity, wind speed, and structure of the plant community and depending on what vegetation management actions, including fuel reduction, would have been conducted prior to the wildfire.

Under Alternative B, with no vegetation management activities occurring, including fuel reduction, a wildfire, under the right meteorological conditions, could potentially result in negligible to moderate adverse effects.

3.4 Water Resources

3.4.1 Introduction

This section describes surface water and groundwater resources at the NCTC and potential effects from taking no action (Alternative A) and effects that would result from Alternatives B and C.

3.4.2 Methodology

3.4.2.1 Analysis Methods and Assumptions

Literature was reviewed to understand how current and proposed management actions at the NCTC would affect water resources and how implementation of resource protection measures would eliminate or minimize potential effects from those actions.

3.4.2.2 Scope of the Analysis

Analysis Area. The proposed management activities would have localized effects on the water resources that are generally confined to the treated areas. Therefore, the direct, indirect, and cumulative effects analyses of water resources are geographically bounded to the lands within the NCTC.

Analysis Period. The timeframe for the effects analysis is 2 years for short-term effects and up to 15 years for long-term effects on water quality.

3.4.2.3 Intensity of Effects

"Intensity" refers to the severity of effects or the degree to which the action may adversely or beneficially affect a resource. The intensity definitions used throughout the effects analysis are described below.

No Effect. The appropriate conclusion when it has been determined an action would not affect water quality and hydrologic conditions.

Negligible or Discountable. The appropriate conclusion when effects would be at the lowest level of detection or extremely unlikely to occur and would have no appreciable effect on water quality and hydrologic conditions.

Minor. Chemical, physical, or biological changes to water quality and hydrology would be detectable in and/or immediately adjacent to treatment units but would be well below limits set by state and federal water quality standards or criteria and would be within historical or desired water quality and hydrologic conditions.

Moderate. Chemical, physical, or biological changes to water quality and hydrology would be detectable downstream of treated areas. Any changes would be at or below limits set by state and federal water quality standards or criteria. Water quality and hydrology would be altered compared to historical baseline or desired water quality and hydrologic conditions.

Major. Chemical, physical, or biological changes to water quality and hydrology would be readily measurable and would be frequently altered from the historical baseline or desired water quality and hydrologic conditions. Chemical, physical, or biological water quality standards or criteria would be periodically exceeded.

3.4.2.4 Measurement Indicators

The indicators used to assess effects on water resources are listed below.

- Sediment delivery
- Pond/stream temperature
- Pond/stream pH

3.4.3 Affected Environment (Existing Conditions) and Environmental Consequences: Water Resources

3.4.3.1 Water Resources: Existing Conditions

There are both intermittent and perennial springs forming small creeks on the NCTC property. The water is "hard," leaving calcium carbonate deposits (travertine) on the creek bottoms, especially where small waterfalls aerate the water. Riverview Run, the creek entering the Potomac River west of the boat ramp, originates on the lower slope of the hillside below the ruins of Riverview Farm. This creek is intermittent and during hot and dry weather only flows at its lower end. Summer water temperatures are in the 57–61 degree Fahrenheit (°F) range, with pH between 8 and 8.5, and dissolved oxygen between 5 and 9 parts per million (ppm).

Springwood Creek begins in several adjacent perennial springheads that feed into a shallow pond near the Springwood estate. The pond changes the chemical nature of the water in the stream below, with summer water temperatures in the 64°F–72°F range, and pH slighter higher in the 8.5 to 8.9 range because of the increased primary productivity using up the available carbon dioxide.

Summer daytime dissolved oxygen levels are about the same in both of these streams, in the 5–9 ppm range. There are no fish in these spring-fed creeks, but snapping turtles, wood turtles, and various amphibians have been found there.

There are six ponds at the NCTC. One is a spring-fed pond (the Springwood Pond) that holds water year-round, and five are storm water management ponds that were built during the construction of NCTC. Two of these hold water year-round; one other holds water during wet periods; one is mostly dry due to a thick population of cattails, as well as hydrologic conditions; and one is currently not holding water due to a sink hole. The ponds have attracted a number of frog, toad, salamander, and insect species and aquatic and wetland plants since pond construction. One of the problematic plant species that requires periodic control is phragmites—this species is discussed in sections 3.2.4.7 and 3.2.4.9 above as it pertains to wildlife habitat.

Summer temperatures, water volumes, and resulting water chemistry limit the survival of some species in these ponds. Daytime water temperatures can be nearly 90°F during the hottest part of the summer. Primary productivity is high during the day because of the algae and other aquatic plants,

leading to supersaturated dissolved oxygen levels and a pH greater than 10. The pH levels at night drop, and dissolved oxygen levels are reduced to zero, creating a rather harsh chemical environment for many aquatic species.

The NCTC lies along one mile of Potomac River front. In the summer the Potomac River has a pH of about 7.5–8, and in the winter, it is between 6 and 7. The water temperatures in the summer can be very warm during periods of low flow. For example, 1999 was a year of severe drought, and the water flow decreased from May through August. The summer daytime water temperatures monitored in the river adjacent to the NCTC ranged from 75°F–90°F.

3.4.3.2 Water Resources: Environmental Consequences, Grasslands

Alternatives A and C—Direct and Indirect Effects from Activity 1: Continue Mowing, Activity 2: Continue Haying, and Activity 3: Continue Planting Desired Species

These actions would not contribute sediment to any water resources at the NCTC and would not affect pond or stream temperatures and pH. Thus, there would be no effects on water resources from Actions 1, 2, and 3 under Alternatives A and C (reminder: haying would not occur under Alternative C).

Alternatives A and C—Direct and Indirect Effects from Activity 4: Continue Chemically Treating Undesirable Species

Herbicide use would not result in adverse effects on water resources.

One source of drinking water contamination in some areas is leaching or runoff from herbicide use. The herbicides used to treat nonnative plants in grasslands at the NCTC are not applied in a significant quantity or in a manner that would adversely affect water resources at the NCTC or that would contribute to contamination of water resources offsite. The effects of herbicides used at the NCTC were discussed above in section 3.2.4.3. The herbicides are also discussed in the next section ("3.5.3.2 Soils: Environmental Consequences, Grasslands"), which describes how the active ingredients bind to soil or are broken down by chemical or microbial processes, thus prohibiting their transfer to the water table.

Alternative C—Direct and Indirect from Activity 5: Proposed Use of Prescribed Fire

There would be no effects on water resources from prescribed burns implemented in grassland areas at the NCTC.

Alternatives A, B, and C—Effects of Wildfire

If a wildfire were to occur in grassland areas, adverse effects would be non-existent to negligible and temporary on water resources. The level of effects from a wildfire would depend on variables that can affect fire behavior such as topography, temperature, humidity, wind speed, and structure and density of the plant community and on what fuel reduction actions would have been conducted (or not conducted under Alternative B) prior to the wildfire.

Alternatives A and C—Cumulative Effects

Continuing to monitor and control the deer population at the NCTC, in combination with management actions in grassland areas, would not produce any cumulative effects on water resources.

Alternative B—Direct and Indirect Effects from Ceasing All Grassland Activities

The lack of any management activities in grassland areas would not affect water resources at the NCTC.

Alternative B—Cumulative Effects

The lack of any management activities in grassland areas, in combination with continuing efforts to monitor and control the deer population at the NCTC, would not produce any cumulative effects on water resources.

3.4.3.3 Water Resources: Environmental Consequences, Mixed-Deciduous Forests

Alternatives A and C—Direct and Indirect Effects from Activity 1: Continue Planting Desired Species and Activity 2: Continue Chemically Treating Undesirable Species

There would be no adverse effects on water resources from continuing to plant desired species and chemically treating undesirable species under Alternatives A and C. These actions would not contribute sediments to any water resources at the NCTC and would not affect pond or stream temperatures and pH.

Alternative C—Direct and Indirect Effects from Activity 3: Proposed Use of Prescribed Fire

There would be either no or negligible temporary adverse effects on water resources from prescribed fire in the mixed-deciduous forests because there would be little chance for soil erosion and sediment delivery to ponds or streams.

Prescribed fire in the forest areas is proposed as an option to treat nonnative plants and reduce fuels. Prescribed fire to reduce fuels would not necessarily occur as a routine treatment. Since forested sites would be burned infrequently, if at all, and only in relatively small areas outside of riparian zones, there would be no adverse effects on mixed-deciduous forests at the NCTC.

Alternatives A, B, and C—Effects of Wildfire

Adverse effects on water resources from a wildfire could range from negligible to moderate and temporary if the wildfire contributed to sediment delivery to ponds or streams at the NCTC. There could be temporary negligible to minor adverse effects on the Potomac River if the sediments reached the river. The variables that would determine the level of adverse effects include weather conditions and moisture content of vegetation at the time of the wildfire and particularly what management actions had been taken to reduce fuel levels in the forests. Even under Alternative B without any vegetation management actions occurring, adverse effects on water resource from a wildfire would be temporary and range from negligible to minor.

Alternatives A and C—Cumulative Effects

Continuing to monitor and control the deer population at the NCTC, in combination with management actions in the mixed-deciduous forest areas, would not produce any cumulative effects on water resources.

Alternative B—Direct and Indirect Effects

The lack of any management activities in mixed-deciduous forest areas would not affect water resources at the NCTC.

Alternative B—Cumulative Effects

The lack of any management activities in mixed-deciduous forest areas, in combination with continuing efforts to monitor and control the deer population at the NCTC, would not produce any cumulative effects on water resources.

3.4.3.4 Water Resources: Environmental Consequences, Riparian/Wetland Habitat

Alternatives A and C—Direct and Indirect Effects from Activity 1: Continue Planting Desired Species and Activity 2: Continue Chemically Treating Undesirable Species

There would be no adverse effects on water resources from continuing to plant desired species and chemically treating undesirable species under Alternatives A and C. These actions would not contribute sediments to any water resources at the NCTC and would not affect pond or stream temperatures and pH.

Alternatives A, B, and C—Effects of Wildfire

Adverse effects on water resources from a wildfire could range from negligible to moderate and temporary if the wildfire contributed to sediment delivery to ponds or streams at the NCTC. There could be temporary negligible to minor adverse effects on the Potomac River if the sediments reached the river. The variables that would determine the level of adverse effects include weather conditions and moisture content of vegetation at the time of the wildfire and particularly what vegetation management actions, including fuel reduction, had been taken to reduce the density of combustible vegetation.

Even under Alternative B without any vegetation management actions occurring, adverse effects on water resource from a wildfire would be temporary and range from negligible to moderate.

Alternatives A and C—Cumulative Effects

Continuing to monitor and control the deer population at the NCTC, in combination with management actions in the riparian/wetland areas, would not produce any cumulative effects on water resources.

Alternative B—Direct and Indirect Effects

The inundation of invasive vegetation in the ponds and wetland areas could lead to lower water levels, which would directly affect water temperature and pH. The lack of any management activities in riparian/wetland areas would have the greatest adverse effect on wildlife species that inhabit these important areas; those effects are described above in section 3.2.4.9.

Alternative B—Cumulative Effects

The lack of any management activities in riparian/wetland areas, in combination with continuing efforts to monitor and control the deer population at the NCTC, would not produce any cumulative effects on water resources.

3.5 Soils

3.5.1 Introduction

This section presents current soil conditions and describes the potential effects on soils from the three alternatives presented in this EA. Geologic features at the NCTC were described in section "3.3 Significant Natural Features and Related Plant and Wildlife Species."

3.5.2 Methodology

3.5.2.1 Analysis Methods and Assumptions

Information on soil types and current conditions at the NCTC were taken from the "Custom Soil and Resource Report for Jefferson County, West Virginia; and Washington County, Maryland." The report was prepared for the NCTC by the U.S. Department Agriculture Natural Resources Conservation Services.

3.5.2.2 Scope of the Analysis

Analysis Area. The analysis of direct, indirect, and cumulative effects on soil resources is geographically bounded to the lands within the NCTC.

Analysis Period. The timeframe for the effects analysis is 2 years for short-term effects and up to 15 years for long-term effects on soils. This area has a relatively high rate of vegetation establishment and growth due to high annual precipitation and productive soils.

3.5.2.3 Intensity of Effects

"Intensity" refers to the severity of effects or the degree to which the action may adversely or beneficially affect a resource. The intensity definitions used throughout this soils analysis are described below.

No Effect. The appropriate conclusion when it has been determined an alternative would not affect soils.

Negligible. The effects on soils would be below or at levels of detection. There would be no discernable effect on the rate of soil erosion and/or the ability of the soil to support native vegetation.

Minor. The effects on soils would be detectable, but effects on soil productivity or fertility would be small. There would be localized, detectable effects on the rate of soil erosion and/or the ability of the soil to support native vegetation.

Moderate. The effect on soil productivity or fertility would be variable due to differences in soil type, topography, and site-specific treatments. The rate of soil erosion and/or the ability of the soil to support native vegetation would be measurably changed. Detrimental disturbance in the form of soil compaction (greater than 10 percent decrease in soil porosity) and displacement (greater than 15 percent loss of soil organic matter in upper 12 inches of soil) are approaching threshold values.

Major. The effect on soil productivity or fertility would be highly variable due to differences in soil type, topography, and site-specific treatments, but readily apparent and would substantially change the character of the soils over a large area within the treatment unit. The actions would have substantial, highly noticeable influence on the rate of soil erosion and/or the ability of the soil to support native vegetation. Detrimental disturbance in the form of soil compaction (greater than 10 percent decrease in soil porosity) and displacement (greater than 15 percent loss of soil organic matter in upper 12 inches of soil) would exceed threshold values, and most likely require on-site mitigation.

3.5.2.4 Measurement Indicators

There are three measures (or indicators) that were used to assess current soil conditions on NCTC property. The same indicators were used to assess effects of Alternatives A, B, and C.

1. Soil cover
2. Organic matter (includes fine organic matter and down wood)
3. Detrimental disturbance (detrimental compaction and detrimental soil displacement)

3.5.3 Affected Environment (Existing Conditions) and Environmental Consequences: Soils

3.5.3.1 Soils: Existing Conditions

NCTC is in the eastern portion of the Mid-Atlantic Ridge and Valley Area #12 physiographic province—characterized by long ridges of resistant sedimentary rock trending northeast to southwest, alternating with linear valleys composed of softer sedimentary rock. The NCTC lies in that portion of the Ridge and Valley province known as the Great Valley, a geologic feature that extends from New York to Alabama (see Map A-7). In Virginia and West Virginia this feature is called the Shenandoah Valley, named for the river that flows through the valley until it meets the Potomac River at Harpers Ferry, West Virginia.

Elevations range from about 300 feet above sea level on the north side of the property adjacent to the river to just over 440 feet on the southern side.

The NCTC property is underlain by a geologic unit known as the Conococheague Limestone, a moderately folded and metamorphosed, sparsely fossiliferous (containing fossils) carbonate of late Cambrian / early Ordovician age. Chemically, it is dominated by calcium and magnesium carbonates, and it also contains occasional shale or sandy layers. The strike of the bedding planes and rock outcrops is generally oriented about N15E. The limestone bedrock is susceptible to sinkholes, fissures, and solution cavities. More resistant layers within this limestone have formed a bedrock sill and Shepherd Island in the Potomac River north of the campus.

Rounded cobbles and gravels of quartzite can commonly be found along the upper river terrace, deposited more than 30,000 years ago when the base level of the Potomac River was at this elevation and eroding the resistant silica-rich ridges to the west. Based on the mapped distribution of these quartzite deposits, the Potomac River has largely stayed within or very near its present channel near NCTC for more than 50,000 years, the elevation largely controlled by a series of bedrock sills.

In upland areas, fairly rich red clay-loam soils have developed in place from the underlying parent material, while the floodplains and benches near the Potomac are composed of fine-grained alluvial soils (alluvial refers to silt/sediment, especially of mud or clay particles at the bottom of a river or lake). The carbonate-derived soils tend to be higher in pH than the more acidic soils of the Blue Ridge and other nearby ridges, which have formed from rock with higher silica content. This explains why some regionally common species (such as white pine, mountain laurel, scarlet oak, and American holly, which do well on the acidic soils) do not occur here in naturally growing stands, although they may sometimes be successfully planted.

Table 10 lists the soils and the acres of each soil type at the NCTC. Soil limitations/characteristics are important to understanding restoration and management potential. Also, soil type plays a role in defining likely historic vegetation patterns and disturbance/fire regimes on NCTC lands. For example, coarse-textured, low-nutrient soils were more likely to support vegetation types that burned frequently; poorly drained soils were likely to support vegetation that burned infrequently.

Table 10. Predominant soil types at the NCTC

Jefferson County, West Virginia			
Map Unit Legend (refer to Map A-7)	**Map Unit Name**	**Acres in NCTC**	**Percent of NCTC**
Cs	Combs fine sandy loam	20.3	3.7
DsC	Downsville gravelly loam, 8% – 15% slopes	7.1	1.3
Fk	Funkstown silt loam	26.7	4.9
HbB	Hagerstown silt loam, 3% – 8% slopes	5.1	0.9
HbC	Hagerstown silt loam, 8% – 15% slopes	13.1	2.4
HeC	Hagerstown silt loam, 8% – 15% slopes, very rocky	32.6	6.0
HgE	Hagerstown-Opequon-Rock outcrop complex, 15% – 35% slopes	119.5	21.8
HrC	Hagerstown-Rock outcrop complex, 8% – 15% slopes	169.4	31.0
MoB	Monongahela fine sandy loam, 3% – 8% slopes	14.7	2.7
PmB	Poplimento silt loam, 3% – 8% slopes	39.5	7.2
PmC	Poplimento silt loam, 8% – 15% slopes	13.3	2.4
ReF	Rock outcrop-Opequon complex, 25% – 60% slopes	2.1	0.4
Uu	Urban land-Udorthents	4.2	0.8
UwC	Urban land-Hagerstown complex, 0 – 15 slopes	77.5	14.2
W	Water	0.6	0.1

Washington County, Maryland			
Map Unit Legend (refer to Map A-7)	**Map Unit Name**	**Acres in NCTC**	**Percent of NCTC**
W	Water	1.3	0.2
	Totals for NCTC	**547.0**	**100.0**

Source: Custom Soil and Resource Report for Jefferson County, West Virginia; and Washington County, Maryland

3.5.3.2 Soils: Environmental Consequences, Grasslands

Alternatives A and C—Direct and Indirect Effects from Activity 1: Continue Mowing, Activity 2: Continue Haying, and Activity 3: Continue Planting Desired Species

The current grass fields at the NCTC are highly disturbed from many years of cropping, haying and pasture prior to construction of the NCTC. Continuing Actions 1, 2, and 3 under Alternatives A and C would not result in any new disturbances that would adversely affect soil cover and organic matter or cause detrimental compaction or soil displacement. (Reminder: haying would not occur under Alternative C.)

Alternatives A and C—Direct and Indirect Effects from Activity 4: Continue Chemically Treating Undesirable Species

The herbicides to be used in grasslands at NCTC were described in sections above and are given in detail in Appendix E. Some characteristics of the products relevant to soil are described below.

- Accord Concentrate (glyphosate) is highly adsorbed on most soils, especially those with high organic content. The compound is so strongly attached to the soil that little is expected to leach from the applied area. Microbes are primarily responsible for the breakdown of the product. The time it takes for half of the product to break down ranges from 1 to 174 days. The herbicide could move when attached to soil particles in erosion run-off, but because glyphosate is so tightly bound to the soil, little is transferred by rain or irrigation water—one estimate showed less than 2 percent of the applied chemical was lost to runoff (CU 1994).

- Milestone VM (aminopyralid) is not readily adsorbed by soil particles and has moderate leaching potential; however, field experiments showed little movement in the soil profile. It is degraded primarily by microbes. It has a half-life of 25 to 35 days (WSSA 2007).

- Escort XP (metsulfuron-methyl) has moderate persistence in soil, with little chemical bonding to clay particles but high adsorption to organic matter. It breaks down by microbial degradation and hydrolysis. Overall, half-life varies from 1 to 6 weeks, depending primarily on soil pH (WSSA 2007).

- Outrider (sulfosulfuron) is somewhat persistent in soil, being transformed by photo degradation, microbial action and hydrolysis. In field studies no quantifiable residues were found deeper than 12 inches. The half-life varies from 14 to 75 days, depending on environmental conditions (WSSA 2007).

- Garlon 3A and Garlon 4 Ultra (triclopyr) are not residual in the soil and degrade quickly in the environment, giving them a favorable environmental profile. The herbicides are broken down by soil microorganisms (fungi and bacteria) and sunlight. The final breakdown products are carbon dioxide, water, and other organic materials. The breakdown rate depends on rainfall and soil temperature and how these factors impact soil microorganism activity—the main cause of breakdown. The time required to break down 50 percent of the active ingredient in soil ranges from 30 to 45 days (DAS 2010a). The herbicides bind (adsorb) to soil particles, and researchers find that most of the active ingredient remains in the upper 12 inches of soil—far from the water table. Thus, there is

little risk of triclopyr reaching groundwater, and it poses no significant environmental hazard due to leaching (DAS 2010b).

- Plateau (imazapic) is fairly persistent but not mobile. It is degraded primarily by microbial action and somewhat by adsorbtion. Field studies indicate that imazapic remains in the top 12 to 18 inches of soil. The average half-life is 120 days. (WSSA 2007)

The herbicides themselves would not have adverse effects on soils, and the application of herbicides would not result in any new disturbances that would adversely affect soil cover and organic matter or cause detrimental compaction or soil displacement.

Alternative C—Direct and Indirect Effects from Activity 5: Proposed Use of Prescribed Fire

Beneficial effects on soils would result from prescribed fire because fire kills woody plants, allowing sunlight to reach the soil and changing the soil pH and nutrient availability. Native grasses and forbs have greater seed production, germination, and establishment after a fire because burning allows plant nutrients to be returned to the soil and used again. There could be some potential for loss of soil cover and organic matter, but no risk of detrimental compaction or soil displacement. The resources protection measures listed in Table 4 (Chapter 2) would be implemented to minimize or eliminate adverse effects on soils

One of the simplest and least expensive practices to improve poor quality grassland is prescribed burning (USGS 2010b), although the effects on soils from fire (both prescribed fire and wildfire) can be extremely variable. Fire increases or decreases soil nutrient amounts, depending on the intensity and duration of the burn. The prescribed burns in NCTC grasslands, in the absence of heavy ground fuels and dead shrubs and small trees, would burn quickly and may not be hot enough to burn deep into the soils. Extreme fire can cause accelerated erosion and require mitigation measures such as rapid re-vegetation (NIFC 2010a, b), which would not be the case at the NCTC.

Alternatives A, B, and C—Effects of Wildfire

The potential for a wildfire to occur under average meteorological conditions in northeastern West Virginia under Alternatives A and B would be low to moderate. A wildfire in a grass field would not result in major adverse effects on soil cover and organic matter, nor would a wildfire cause detrimental compaction or soil displacement. Even in the absence of any vegetation management actions under Alternative B, a wildfire in a grass field would not result in major adverse effects on soil cover and organic matter nor would a wildfire cause detrimental compaction or soil displacement.

As with prescribed fire under Alternative C, a wildfire could result in beneficial effects on soils as described above for prescribed fire under Alternative C.

Alternatives A and C—Cumulative Effects

Continuing to monitor and control the deer population at the NCTC, in combination with management actions in grassland areas, would not produce any cumulative effects on soils.

Alternative B—Direct and Indirect Effects

The lack of any management activities in grassland areas would not affect soils resources at the NCTC.

Alternative B—Cumulative Effects

The lack of any management activities in grassland areas, in combination with continuing efforts to monitor and control the deer population at the NCTC, would not produce any cumulative effects on soils.

3.5.3.3 Soils: Environmental Consequences, Mixed-Deciduous Forests

Alternatives A and C—Direct and Indirect Effects from Activity 1: Continue Planting Desired Species

Continuing to plant desired species under Alternatives A and C would not result in any disturbances that would adversely affect soil cover and organic matter or cause detrimental compaction or soil displacement.

Alternatives A and C—Direct and Indirect Effects from Activity 2: Continue Chemically Treating Undesirable Species

The herbicides to be used in mixed-deciduous forest at NCTC were described in section 3.5.3.2 above, and effects would be the same as those presented for Activity 4 in grassland areas. One other herbicide may be used in the forest areas; it is described below.

- Sethoxydin E-Pro (sethoxydim) is not persistent or mobile in soil. It is transformed by adsorbtion, photodegradation, and microbial action. It is rapidly degraded, having an average half-life of 5 days (WSSA 2007).

Herbicide use would not result in other than minor and temporary adverse effects on soils.

Alternative C—Direct and Indirect Effects from Activity 3: Proposed Use of Prescribed Fire

Prescribed fire in the forest areas is proposed as an option to treat nonnative plants and reduce fuels, but fuels reduction would not necessarily occur as a routine treatment. Prescribed fire in the forest areas would have the same beneficial effects on soils as described above under grassland Activity 5.

There could be some potential for loss of soil cover and organic matter, but no risk of detrimental compaction or soil displacement.

Alternatives A, B, and C—Effects of Wildfire

The potential for a wildfire to occur under average meteorological conditions in northeastern West Virginia is low to moderate. As with prescribed fire under Alternative C, a wildfire could result in the same beneficial effects on soils.

A wildfire in a forest area would not result in major adverse effects on soils, although there would be some potential for loss of soil cover and organic matter, depending on the severity of the fire, but no risk of detrimental compaction or soil displacement. However, extreme fire can cause accelerated erosion and require mitigation measures such as rapid revegetation (NIFC 2010a, b).

Alternatives A and C—Cumulative Effects

Continuing to monitor and control the deer population at the NCTC, in combination with management actions in the mixed-deciduous forest areas, would not produce any cumulative effects on soils.

Alternative B—Direct, Indirect, and Cumulative Effects

The lack of management activities in mixed-deciduous forest areas would not lead to adverse effects on soil cover and organic matter nor would it lead to detrimental compaction or soil displacement. Alternative B, in combination with continuing efforts to monitor and control the deer population at the NCTC, would not produce any cumulative effects on soils.

3.5.3.4 Soils: Environmental Consequences, Riparian/Wetland Areas

Alternatives A and C— Direct and Indirect Effects from Activity 1: Continue Re-establishing Desired Species and Activity 2: Continue Chemically Treating Undesirable Species

There would be no short- or long-term adverse effects on soils from planting desired species in riparian/wetland areas or from the use of herbicides.

Alternatives A and C—Cumulative Effects

Continuing to monitor and control the deer population at the NCTC, in combination with management actions in the riparian/wetland areas, would not produce any cumulative effects.

Alternative B—Direct, Indirect, and Cumulative Effects

The lack of management activities in riparian/wetland habitat would not lead to direct or indirect adverse effects on soil cover and organic matter nor would it lead to detrimental compaction or soil displacement. Alternative B, in combination with continuing efforts to monitor and control the deer population at the NCTC, would not produce any adverse cumulative effects on soils.

Alternatives A, B, and C—Direct and Indirect Effects

A wildfire in a riparian/wetland area would not result in major adverse effects on soils, although there could be some potential for loss of soil cover and organic matter, depending on the severity of the fire, but no risk of detrimental compaction or soil displacement. However, extreme fire can cause accelerated erosion and require mitigation measures such as rapid revegetation (NIFC 2010a, b).

3.6 Social Values

3.6.1 Introduction

This section contains discussions on human health and safety; significant values, including cultural resources; and environmental justice. Mowing, haying, and planting desired species would have no effects on human health and safety, significant values, or environmental justice, so those actions are not discussed in this section.

3.6.2 Methodology

3.6.2.1 Scope of the Analysis

Analysis Area

- The analysis area for human health and safety includes all lands within the 532-acre NCTC and extends 2 miles outside the NCTC to include privately owned lands along the NCTC boundary and the communities of Leisure Acres and North Terrapin Neck—both communities have been identified in the *Federal Register* as "Communities at Risk" from wildfire on federal lands. A number of laws and regulations to protect human health and safety govern activities on federal property, including the *Federal Highway Safety Act*, Occupational Safety and Health Administration regulations, and air quality regulations (*Clean Air Act*).

- The analysis area for significant values is the core campus area at the NCTC. The historic resources on the NCTC are protected under the *National Historic Preservation Act*.

- The analysis area for environmental justice is the residential areas immediately surrounding the NCTC. Executive Order 12898 guides the analysis of effects on low-income and minority populations who may be affected by federal agency actions.

- The approximately 430 acres outside the core campus area are managed primarily as wildlife habitat and were discussed above in section 3.2.

Analysis Period. The timeframe for the effects analysis is 2 years for short-term effects and up to 15 years for long-term effects on social values. Some effects would be temporary and only occur during implementation of land management activities.

3.6.2.2 Intensity of Effects

"Intensity" refers to the severity of effects or the degree to which the action may adversely or beneficially affect a resource. The intensity definitions presented below are used to describe effects on social values.

No Effect. The appropriate conclusion when it has been determined an alternative would not affect social values.

Negligible. Effects would be at the lowest levels of detection and would have no appreciable effect on resources or values.

Minor. Effects would be perceptible but slight and localized.

Moderate. Effects would be readily apparent and widespread and would result in a noticeable change to resources or values.

Major. Effects would be significant and readily apparent and widespread and would result in a substantial alteration (beneficial or adverse) or loss of resources or values.

3.6.3 Affected Environment (Existing Conditions) and Environmental Consequences

3.6.3.1 Human Health and Safety: Existing Conditions

Pesticides

Current and Proposed Herbicide Use to Control Invasive Plants. Herbicides (such as Accord Concentrate, Milestone VM, Escort XP, Garlon 3A, Garlon 4 Ultra, Outrider, Sethoxydim E-Pro, and Plateau) are currently used or proposed to be used at the NCTC for controlling invasive plants.

Products Proposed to Control Other Pests. Pesticide products under consideration for treatment of various pests at the NCTC are the herbicides Accord Concentrate, Pendulum AquaCap, and SureGuard; the insecticides horticultural oil, insecticidal soap, neem oil, Dipel, Pyrethrin, Conserve, Merit 2F, and Talstar; the fungicides lime-sulfur and Daconil; and the rodenticides Rodex Pelleted Bait, and ERAZE Rodent Pellets.

Further information on potential health and safety risks from these products is included in section 3.6.3.2 below, as well as in Appendix E. All pesticides sold in the United States must be accepted for registration by the EPA based on a minimum of 120 scientific studies showing that the pesticide will perform its intended function without unreasonable adverse effects on humans, animals, or the environment. The EPA defines unreasonable adverse effects as any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of the pesticide.

Prescribed Fire and Air Quality

Local air quality affects how we live and breathe. Like the weather, it can change from day to day or even hour to hour. The EPA and the West Virginia Department of Environmental Protection (WVDEP)–Division of Air Quality (DAQ) use a standardized system, referred to as the Air Quality Index (AQI), to provide the public with timely and easy-to-understand information on local air quality and whether air pollution levels pose a health concern. Air Quality data is currently collected at the WVDEP–DAQ in Charleston and at the Northern Panhandle Regional Office in Wheeling. The EPA criteria pollutant data is analyzed, quality assured, and reported from monitoring stations located in Charleston, Greenbrier County, Huntington, Martinsburg, Morgantown, Parkersburg, Weirton, and Wheeling to determine the AQI for those areas.

The National Ambient Air Quality Standards, or NAAQS, were established for acceptable concentrations of specific pollutants in the ambient (outdoor) air. Six principal pollutants currently have NAAQS: carbon monoxide, lead, nitrogen dioxide, ground-level ozone, particulate matter (PM_{10} and $PM_{2.5}$), and sulfur dioxide. These are commonly called the "criteria pollutants."

The Air Monitoring Section of the WVDEP–DAQ has ambient air quality sampling sites throughout West Virginia. The sampling sites monitor air pollutants on either a continuous or periodic basis. The sampling sites are located to assess air quality levels based on population exposure, industry emissions to determine compliance with the NAAQS; assess background levels; and for other special purposes. The data collected is used by the WVDEP–DAQ to implement programs to ensure attainment of NAAQS for criteria pollutants. (Attainment refers to an area that meets air quality standards for a pollutant; an area that does not fall within [meet] the standards is in nonattainment.)

The NCTC lies within Jefferson County. The nearest sampling site to the NCTC is in Martinsburg (Berkeley County, West Virginia), approximately 10 miles to the west. The air pollutants and parameters monitored are shown in Table 11 below.

Table 11. Criteria pollutant data for Berkeley County and West Virginia

Air Pollutant	Berkeley County Sample Site Based on 2009 Monitoring Data	National Ambient Air Quality Standards[a]
Current AQI[b] Ozone per Martinsburg Sample Site[c]	AQI = 62 AQI = 46	Moderate to Good[b]
Carbon Monoxide	Not measured[d,f] Attainment[e]	8-hour average: 9 ppm 1-hour average: 35 ppm
Lead	Not measured[d,f] Attainment[e]	Quarterly Average: 0.5 µg/m^3[3, g] Rolling 3-Month Average: 0.15 µg/m^3
Nitrogen dioxide	Not measured[d,f] Attainment[e]	Annual Mean: 100 µg/m^3
Particulate Matter (PM_{10})	Not measured[d,f] Attainment[e]	24-hour.: 150 µg/m^3 Annual Mean: 50 µg/m^3
Particulate Matter ($PM_{2.5}$)	33.7 µg/m^3 15.36 µg/m^3 Not measured[d] Attainment[e]	24-hour average: 35 µg/m^3 Annual Mean: 15 µg/m^3
Ozone	0.087 ppm 0.069 ppm Attainment[e]	1-hour average: 0.120 ppm 8-hour average: 0.075 ppm
Sulfur Dioxide	Not measured[d,f] Attainment[e]	Annual Mean: 0.03 ppm (80 µg/m^3) Maximum 24-hour: 0.14 ppm (365 µg/m^3)

Notes:

a. The NAAQS for criteria pollutants found at http://www.epa.gov/air/criteria.html

b This AQI is taken from EPA's AIRNow website (http://www.airnow.gov/index.cfm?action=aqibasics.index) for Northern Virginia; there are no EPA AQIs for West Virginia. "Good" AQI is 0 - 50. Air quality is considered satisfactory, and air pollution poses little or no risk. "Moderate" AQI is 51 - 100. Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people. For example, people who are unusually sensitive to ozone may experience respiratory symptoms.

c. Martinsburg sample site AQI taken from http://www.dep.wv.gov/daq/air-monitoring/Pages/AirQualityIndex.aspx.

d. The Martinsburg sample site does not measure this pollutant.

e. Attainment status taken from http://www.scorecard.org/env-releases/cap/naa.tcl

f. No EPA data for Berkeley County (2008 Report) http://iaspub.epa.gov/airsdata/adaqs.summary?geotype=st&geocode=WV&geoinfo=st%7EWV%7EWest+Virginia&year=2008&fld=county&fld=stabbr&fld=regn&rpp=25

g. µg/m^3= micrograms per cubic meter

The Fire Management Plan for the NCTC describes actions to plan and conduct prescribed fires, to prepare for and respond to unplanned ignitions, and to complete other fire management business. Individual prescribed burn plans (prepared prior to implementation of each burn) will specify conditions required for burning to minimize adverse effects on air quality from prescribed fire. Smoke-sensitive areas will be identified in each prescribed burn plan. The burn plans will specify wind directions or other factors to minimize potential for smoke effects on sensitive populations. Special consideration will be given to neighbors who have pre-existing respiratory conditions.

Prescribed Fire and Safety

It is important to understand predicted fire behavior prior to conducting prescribed burns so that personnel implementing the burns can take all necessary safety precautions. The Fire Management Plan shows the predicted fire behavior (refer to Table 8 above) under current vegetative conditions. The desired fire behavior has been added to Table 8. Only the grassland areas do not currently meet desired fire behavior. Table 8 confirms the statements in section "3.2 Habitat and Wildlife" for the mixed-deciduous forests that prescribed fire to reduce fuel loads is a low priority based on current fuel loads and meteorological conditions, and that there is low to moderate potential for a devastating wildfire. Prescribed fire is proposed in the forest areas primarily as needed to control invasive plants, and may also be used as a treatment option to reduce ground and ladder fuels in the event long-range weather predictions show considerably less-than-average precipitation and warmer-than-normal temperatures for an extended period of time. Prescribed fire is not proposed in any of the riparian/wetland areas.

3.6.3.2 Human Health and Safety: Environmental Consequences

Alternatives A and C—Direct and Indirect Effects from Continuing to Chemically Treat Undesirable Plant Species and Control Other Pests

Refer to Appendix E for more information on the following products:

Herbicides

- Accord Concentrate (glyphosate). The EPA's worst case risk assessment of glyphosate's many registered food uses concludes that human dietary exposure and risk are minimal, and that it is of relatively low oral and dermal acute toxicity. Exposure to workers and other applicators generally is not expected to pose undue risks, due to glyphosate's low acute toxicity. However, splashes during mixing and loading of some products can cause injury, primarily eye and skin irritation. Glyphosate is nonvolatile, and inhalation studies show low toxicity.
- Milestone VM (aminopyralid). Studies indicated that aminopyralid has very low (virtually nontoxic) acute oral and dermal toxicity and is not likely to cause cancer, birth defects, or reproductive effects. It has potential to cause eye irritation if directly exposed to the product (WSSA 2007).
- Escort XP (metsulfuron-methyl). Studies indicated that metsulfuron-methyl has very low (virtually nontoxic) acute oral and dermal toxicity and is not likely to cause cancer, birth defects, or reproductive effects. It has potential to cause eye irritation if directly exposed to the product (WSSA 2007).
- Garlon 3A and Garlon 4 Ultra (triclopyr). The active ingredient in these two herbicides has been classified by the EPA as "practically nontoxic" (the least toxic category used by EPA).

Toxicological studies show no evidence that triclopyr causes cancer, birth defects, genetic damage, genetic mutation, or adverse effects on the immune system or nervous system in humans.

- Outrider (sulfosulfuron). Toxicological studies found that sulfosulfuron has very low (virtually nontoxic) acute oral and dermal toxicity and is not likely to cause cancer, birth defects, or reproductive effects. Bladder and urinary tract problems were found in test animals fed this chemical for 12 to 24 months (WSSA 2007).
- Sethoxydim E-Pro (sethoxydim). Toxicological studies found that sethoxydim has low acute oral toxicity and very low acute dermal toxicity and is not likely to cause cancer, birth defects, or reproductive effects. It has potential to cause eye irritation if directly exposed to the product.
- Plateau (imazapic). Toxicological studies found that imazapic has very low (virtually nontoxic) acute oral and dermal toxicity and is not likely to cause cancer, birth defects, or reproductive effects. It can cause eye irritation if directly exposed to the product (WSSA 2007).
- Pendulum AquaCap (pendimethalin). In studies using laboratory animals, pendimethalin generally has been shown to be of low acute toxicity. It is slightly toxic by the oral and eye route and has been placed in Toxicity Category III (the second lowest of four categories) for these effects. It is practically nontoxic by the dermal and inhalation routes.
- SureGuard (flumioxazin). Applicators must use appropriate protective gear because use of flumioxazin may result in short- and intermediate-term dermal and inhalation exposure during mixing, loading, applying, and post-application activities. Flumioxazin is classified as a "not likely" human carcinogen.

Insecticides

- Horticultural Oil. Toxicity is minimal, and oils quickly dissipate through evaporation, leaving little residue. Oils pose few risks to people.
- Insecticidal Soap (potassium fatty acids). The soaps do not persist in the environment. They may cause temporary eye irritation and mild skin irritation if not handled properly.
- Neem Oil. It is nontoxic to humans but may cause mild reversible skin or eye irritation in humans if not handled properly.
- Dipel (*Bacillus thuringiensis* [BT]). The EPA does not anticipate any toxicological or pathogenic problems with *Bacillus thuringiensis*.
- Pyrethrin (pyrethrin). EPA data indicate that pyrethrins have low acute toxicity via oral, dermal, and inhalation routes of exposure and are not skin sensitizers.
- Conserve (spinosad). It was accepted for review and registration by the EPA through its Reduced Risk Pesticide Initiative, a program, which began in 1993, that expedites the review and registration decision-making process of new pesticides that have been shown to pose less risk to human health and the environment than existing conventional alternatives. Conserve® SC turf and ornamental insect control carries no precautionary signal word based on its favorable toxicological and environmental profile, and the Worker Protection Standard re-entry interval is only four hours.

- Merit 2F (imidicloprid). Imidacloprid is very low in toxicity via dermal exposure and no observed eye irritation during research studies. The EPA has classified imidacloprid into Group E, no evidence of carcinogenicity.
- Talstar (bifenthrin). This product is expected to have low oral and dermal toxicity but is expected to be irritating to the skin and eyes. Studies on chronic exposure to bifenthrin at the highest exposure levels reveal that it does not cause reproductive toxicity. None of the ingredients in Talstar are known or listed carcinogens.

Fungicides

- Lime-Sulfur (calcium polysulfide). Lime-sulfur poses no risks that require mitigation. The EPA waived all environmental fate data requirements. The risks associated with exposure to sulfur appear to be low. The EPA has determined that calcium polysulfide rapidly degrades to calcium hydroxide and sulfur in the human body and poses no unacceptable risks to humans. Thus, the data requirements for the higher tier toxicity studies have been waived by the EPA.
- Daconil (chlorothalonil). Chlorothalonil is in acute Toxicity Category IV (the least toxic of four categories) for the oral route of exposure and in Toxicity Category II for the inhalation route. For acute dermal effects and acute skin irritation, chlorothalonil is in Toxicity Category IV.

Rodenticides

- Rodex Pelleted Bait (warfarin). Rodenticides can pose significant risks to children. EPA's requirement to use rodenticides in tamper-resistant bait stations is to decrease the potential for children's accidental exposure (through ingestion and contact). In addition to ingestion risks, rodenticides can be slightly irritating to the eyes.
- ERAZE Rodent Pellets (zinc phosphide). As with other rodenticide products, the EPA requires that this pelleted bait product be used in tamper-resistant bait stations. This product must be kept away from humans, domestic animals, and pets. It is harmful if swallowed, absorbed through the skin, inhaled, or comes in contact with the eyes.

The resource protection measures presented in Table 4 were designed to guard against any adverse effects on human health and safety, even though the prescribed herbicides are practically nontoxic. The resource protection measures will be implemented to ensure that people, especially children, would not be adversely affected by pesticide applications.

Alternative C—Direct and Indirect Effects from Proposed Use of Prescribed Fire

Prescribed Fire and Air Quality. A Burn Day spot forecast will be obtained from the National Weather Service at Sterling, Virginia, to evaluate atmospheric conditions. The NCTC will meet the *Clean Air Act* emission standards by adhering to the West Virginia Air Quality requirements during all prescribed fire activities. The county's attainment status would not be affected by the prescribed burn activities.

Smoke from fires (particularly wildfires) increases particulate and gaseous emissions, particularly PM_{10}, $PM_{2.5}$, and CO. Prescribed fires could briefly reduce air quality in the immediate vicinity of the NCTC. Any adverse effects from the prescribed burns would be temporary and could range from negligible to minor because the burns would be conducted according to the resource protection measures and additional guidance contained in the Fire Management Plan. Off-site adverse effects are

expected to be negligible given the relatively small units that would be burned and the light fuel loads that would be consumed at the NCTC.

Smoke emissions during prescribed burning may temporarily reduce visibility in some locations, but implementation of smoke management practices and plans (such as burning during favorable weather conditions when smoke is carried away from sensitive areas) and using the best available fire and emission control measures would minimize visibility impairments. Thus, emissions can be directed away from sensitive receptors, minimizing health hazards.

Prescribed Fire and Safety. The resource protection measures and additional guidance contained in the Fire Management Plan ensure that personnel conducting the burns will take all necessary safety precautions to protect themselves, staff, and visitors at the NCTC, and NCTC neighbors. Risks to human safety would be negligible.

Alternatives A and C—Cumulative Effects

Continuing to monitor and control the deer population at the NCTC, in combination with land management actions throughout the NCTC, would not produce any adverse cumulative effects on human health and safety.

Alternatives A, B, and C—Effects of Wildfire

Human safety is the first priority during a wildfire, and evacuation of staff and visitors would occur if wildfire threatened occupied structures. Any adverse effects from smoke would be temporary and negligible to minor. There would be no long-term adverse effects on human health and safety from a wildfire. Creating and maintaining defensible space around structures would promote public safety.

A wildfire would have a temporary but potentially minor to major increase in emissions and degradation of air quality, depending on vegetative and meteorological conditions at the time of the fire. A single event, however, would not affect the county's attainment status. There could be an indirect beneficial effect if prescribed fire is used to reduce fuel loads because emissions from any future wildfire would be reduced.

The NCTC's Fire Management Plan presents actions that would be taken in the event of a wildfire.

Alternative B—Direct and Indirect Effects

The lack of treatments to manage invasive plant species could lead to adverse effects on human health and safety since some of these plants have characteristics such as thorns (multiflora rose, Japanese barberry); irritating prickles (mile-a minute); stinging hairs (stinging nettle); or cause allergic dermatitis (poison ivy, Japanese hop). People could also be adversely affected by other pests, such as insects and rodents.

Alternative B—Cumulative Effects

The lack of any management activities at the NCTC, in combination with continuing efforts to monitor and control the deer population, would not produce any cumulative effects on human health and safety.

3.6.3.3 Significant Values: Existing Conditions

The core campus area is where the primary NCTC functions take place. Twenty major FWS-owned structures are in the core campus area, including the information/reception/museum building, two instructional buildings, a science laboratory, an audio-visual production facility, four lodges, the commons, the Children's Center, and utility and maintenance facilities. The site includes the 4-acre Hendrix in-holding, which includes two homes, a barn, and other small outbuildings. The zone immediately surrounding the core area receives more moderate use—it includes maintained fields, walking and jogging trails, and cultural resources such as the spring house, historic horse track, old house foundation, and cemetery. The core campus area also includes paved walkways and roads and adjacent landscaped areas. Trails are maintained with wood chips and/or mowing. Signs, trail markers, historical markers, and other interpretive materials are encouraged in this area. Safety, accessibility, and aesthetic considerations are of primary concern. The estimated replacement cost of government-owned facilities at the NCTC is approximately $575 million.

The NCTC property contains cultural resources, including evidence of Native American use for more than 9000 years, to more recent sites from the American Colonial and settlement period. Cultural resources include archaeological, historic, or architectural sites, structures, or places with historically significant values and uses, and may include locations (sites or places) of traditional cultural or religious importance to specific social or cultural groups. The passage of the *National Historic Preservation Act* (1966) and *National Environmental Policy Act* (1969) lead to increased awareness of the cultural and scientific value of cultural resources on public lands. The *Archaeological Resources Protection Act* (1979) provided additional protections for cultural resources on public and tribal lands. Federal agencies are required to protect historically and culturally significant resources from inadvertent loss, destruction, or impairment.

3.6.3.4 Significant Values: Environmental Consequences

Alternatives A and C—Direct and Indirect Effects from Mowing

The historic race track is the only cultural resource that would be affected by mowing. The effects would be beneficial because this would minimize the development of noxious weeds, prevent the establishment of woody vegetation, and help keep the site in open grassy vegetation similar to the past and current condition.

Alternatives A and C—Direct and Indirect Effects from Continuing Chemically Treating Undesirable Species

Herbicide use would have no direct adverse effects on significant values. There would be indirect beneficial effects because invasive plant species would be treated before they have had a chance to become overgrown and cause damage to cultural resources and the other significant values listed above in section 3.6.3.3.

Alternative C—Direct and Indirect Effects from Controlling Other Pests

The use of pesticides (such as insecticides, fungicides, and rodenticides), when carried out as part of a comprehensive IPM program, would have no direct adverse effects on significant values. There would be direct and indirect beneficial effects by minimizing potential incursion into structures by insects and protecting aesthetically important landscape vegetation from damage or mortality from insects, diseases, rodents, or other pests.

Alternative C—Direct and Indirect Effects from Proposed Use of Prescribed Fire

The resource protection measures and other guidance from the NCTC Fire Management Plan will guide prescribe fire activities wherever they may occur at the NCTC. Prescribed fire would not occur within 100 feet of any cultural resources, including historic structures, or any other buildings. Any potential adverse effects on significant values would likely be avoidable, and if any effects were to occur, they would be negligible and temporary, primarily from smoke. The moderate to major beneficial effects would be long term due to reduced wildfire risk and the continued maintenance of defensible spaces.

Alternatives A and C—Cumulative Effects

Continuing to monitor and control the deer population at the NCTC, in combination with proposed management actions, would not produce any adverse cumulative effects on significant values.

Alternatives A, B, and C—Effects of Wildfire

There is a low potential for a devastating wildfire to occur at the NCTC due to high annual precipitation, humidity, and moisture content of vegetation. The campus area has a good water supply, and all facilities have defensible spaces that allow for structure protection to be safely made in advance of wildfire; thus, there would only be a slight potential for a wildfire to adversely affect NCTC structures. There is a very minor risk of loss or damage to guest vehicles near the edges of parking lots near the lodges. Maintenance of defensible spaces under Alternatives A and C would ensure continued protection of NCTC structures—a beneficial effect. Any adverse effects on significant values would be nonexistent to negligible and temporary, primarily from smoke. Alternative B would not provide the same amount of protection because not all defensible spaces would be maintained. Adverse effects on significant values could range from negligible to major and potentially permanent if cultural resources are destroyed.

Alternative B—Direct and Indirect Effects

Noxious weed invasion can increase risks to cultural resources through increased erosion, reduced shading, changes in soil pH, and other environmental changes. There could be adverse effects if invasive plant species are not treated and allowed to become overgrown, which could potentially cause damage to cultural resources and the other significant values listed above in section 3.6.3.3. The lack of management actions to control nonnative invasive plants would not protect historically and culturally significant resources from inadvertent loss, destruction, or impairment. Adverse effects on significant values could range from negligible to major and could be long term or permanent if defensible spaces are not maintained to protect against a wildfire. The potential for that level of adverse effects, however, is very small considering the low ignitability of vegetation at the NCTC. However, fire risk could increase, depending on predicted meteorological conditions.

Alternative B—Cumulative Effects

Alternative B, in combination with continuing efforts to monitor and control the deer population at the NCTC, would not produce any adverse cumulative effects on significant values.

3.6.3.5 Environmental Justice

Affected Environment

Executive Order 12898 requires that each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, "disproportionately high and adverse human health or environmental effects" of its programs, policies, and activities on minority populations and low-income populations.

This assessment was conducted using the format described in the "Guide for Environmental Justice Analysis with the Environmental Impact Analysis Process" (USAF 1997). The analysis area for Environmental Justice is Jefferson County, West Virginia—a semi-rural area within commuting distance of Washington DC.

The census data for Jefferson County was obtained from the Final 2004 Jefferson County Comprehensive Plan (JC 2004).

Population. According to the 2000 census, 42,190 persons resided in Jefferson County in 16,165 households. Based on data from the U.S. Census Bureau, the Regional Research Institute at West Virginia University, and county data, and the Department of Planning, Zoning, and Engineering projects the population of the county will increase to approximately 51,429 residents by the year 2010; a 21.9 percent increase over the population recorded in the 2000 census. By 2020 the department projects that the population will increase to 62,692; a 21.9 percent increase over 2010 and a 48.6 percent increase over 2000 (JC 2004).

The Minority Population. The 2000 Census revealed that 2,571 African-Americans lived in the county at that time, representing 6.1 percent of the county's population. In absolute numbers, the African-American community experienced an approximate 10 percent decrease of their overall population count since 1980, and their presence as a percentage of the overall population decreased from approximately 15 percent to a little over 6 percent. The remaining 2.9 percent of the population recorded in the 2000 Census collectively represents all remaining minority groups; predominantly Hispanics, East Asians, and Native Americans (JC 2004). The United States Census Bureau reports the county population as 90.5 percent Caucasian, 6.9 percent African American, 0.2 percent American Indian, 0.8 percent Asian, 4.1 percent Hispanic or Latino, and no representation from Native Hawaiians or other Pacific Islanders (USCB 2005).

Personal Income. One significant trend for the county is the sizable increase in personal income levels experienced since 1970. While there has always been a certain number of persons willing to commute 60–90 minutes to Rockville, Fairfax, and Washington DC, this substantial increase has really been felt since the outer suburbs of Washington DC (specifically Frederick, Leesburg, and the Dulles Airport area) have become major employment centers in their own right. These areas are within a reasonable commute for Jefferson County residents to seek work, making the county a sensible choice in selecting a home for those who work in those areas. Given the number of quality employment opportunities in the region, the per capita income of Jefferson County residents has increased 233 percent from 1980 to 2000. When comparing the county's $44,374 median household income to the state's $29,696 and the nation's $41,994, Jefferson County can be described as a middle class county in a poor state (JC 2004).

Environmental Justice: Environmental Consequences

No disproportionately high or adverse human health or environmental effects on minority populations and low-income populations would occur under Alternatives A, B, or C.

3.7 Short-term Uses and Long-term Productivity

The *National Environmental Policy Act* requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by Congress under the act, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare; to create and maintain conditions under which man and nature can exist in productive harmony; and fulfill the social, economic, and other requirements of present and future generations of Americans.

Short-term uses, and their effects, are those that occur within the first few years of project implementation. Long-term productivity refers to the capability of the land and resources to continue producing goods and services long after the project has been implemented. Long-term productivity would be maintained through the application of the resource protection measures described in Chapter 2.

None of the proposed alternatives would affect short-term uses or alter long-term productivity of resources at the NCTC.

3.8 Unavoidable Adverse Effects

Unavoidable adverse effects would occur during implementation of proposed treatments at the NCTC. Some wildlife species may be temporarily displaced during mowing, haying, and prescribed burns. There would be some unavoidable temporary negligible adverse effects on staff and visitors at the NCTC and on private land owners from smoke during prescribed burns. These activities are necessary to achieve long-term beneficial effects from the management activities, and although there may be potential adverse effects, they would not be significant. Table 4 presents the resource protection measures designed to minimize or eliminate potential adverse effects.

3.9 Irreversible and Irretrievable Commitment of Resources

An *irreversible* commitment of resources is a permanent or essentially permanent loss of nonrenewable resources, such as mineral extraction, heritage (cultural) resources, or to those factors that are renewable only over long time spans or at great expense (for example, soil productivity), or to resources that have been destroyed or removed. The only potential permanent loss would be to cultural resources at the NCTC if a potentially devastating wildfire were to occur under Alternative B because no defensible spaces would be maintained, and the potential is very minimal due to low ignitability of vegetation at the NCTC. No other irreversible commitments of resources were identified for the project.

Irretrievable commitment applies to losses that are not renewable or recoverable for future use. The loss of production would be irretrievable, but it would not necessarily be irreversible. None of the alternatives constitutes an irretrievable commitment of resources.

3.10 Cumulative Effects

Cumulative effects are discussed in the individual resource sections earlier in this chapter.

3.11 Energy Requirements, Conservation Potential, Depletable Resource Requirements

Consumption of fossil fuels by vehicles and equipment will occur with the action alternatives during management activities. No unusual energy requirements are included nor do opportunities exist to conserve energy at a large scale.

3.12 Prime Farmland, Rangeland, and Forest Land

As designated by the United States Department of Agriculture–National Resource Conservation Service and described in the National Soil Survey Handbook (USDA-NRCS 2010), the NCTC does contain approximately 166 acres of soils designated as both "prime farmland" (87 acres) and the slightly less desirable "farmland of statewide importance" (79 acres). Prime farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. Prime farmland information may be supplemented with separate designations of soil map units that have statewide, local, or unique importance as farmland capable of producing crops. There are no areas designated as prime rangeland or prime forest land. Some of these (combined "prime" and "statewide") soils are currently in woodlands (71 acres), which might therefore possibly be construed as prime forest. However, since these are mostly former crop, hay or pasture fields that were allowed to go fallow during the last 20 years, they are mostly covered with small trees, either scattered and mixed with invasive trees, shrubs, and vines or are dense thickets of boxelder. The effects on forest land that could result from land management activities are described in section 3.2.

There are approximately 95 acres of these combined soils that are currently in grassland. Of these approximately 23 acres are in hay, 20 acres are in other cool-season grasses, and 52 acres are in warm-season grasses.

3.13 Possible Conflicts with Other Land Use Plans

The land management actions would take place entirely on FWS lands.

3.14 Other Required Disclosures

There are no federally listed plant species on NCTC lands. The Madison case isopod and Indiana bat are federally endangered species that are known to occur or believed to occur near the Shenandoah River in Jefferson County. More information can be found above in section "3.3.3.4 Cave Habitat: Existing Conditions."

A Level 1 archeological survey was conducted on NCTC property prior to construction and is recorded in the environmental assessment for development of the NCTC prepared by Greenhorne and

O'Mara in 1992. A Level 3 archeological survey was subsequently carried out at the boat ramp to investigate evidence of Native American occupancy.

No properties on the National Register of Historic Places would be affected. The C&O National Historic Park is registered, but any activities considered under in this EA would not affect or be visible from that property, with the possible exception of smoke from a prescribed burn. If smoke were noticeable from the canal, it would be minor and of short duration. Park staff will be notified prior to prescribed burning. Two nearby sites, the Hendrix Farm and Wild Goose Farm, are not listed on the national register but might be eligible for listing.

Chapter 4. Consultation and Coordination

4.1 Preparers and Contributors

Name, Title	Responsibility
Phil Pannill NCTC Land Manager	• EA project manager • EA writer and editor • Prepared Scoping Summary (Appendix C) • Reviewed public comments on the draft EA
Susan Hale Consultant, Project Support Services	• NEPA coordinator • EA writer and editor • Prepared Scoping Summary (Appendix C) • Reviewed public comments on the draft EA
James (Jay) Slack NCTC Director	• Reviewed draft and final EAs and provided comments
Karin Christensen Chief, NCTC Facility Operations Division	• GIS/map preparation • Reviewed internal draft EA and provided comments
Karen Lindsey NCTC Course Leader (formerly NCTC Land Manager)	• Reviewed internal draft EA and provided comments • Prepared 2005 draft land management plan
Fred Wetzel National FWS Fire Program Advisor	• Reviewed draft EA and provided comments
Mike Broughton Smoke Management Specialist	• Reviewed draft EA and provided comments
Tim Fannin Chief, Region 5 Division of Habitat and Contaminants	• Reviewed draft EA and provided comments

4.2 Federal, State, and Local Agency Collaboration and Consultation

In addition to those persons listed in section 4.1 above, input on various aspects of this assessment was solicited and received from personnel from FWS Northeast Region, including the West Virginia Ecological Services Field Office regarding threatened or endangered species; West Virginia Division of Forestry; West Virginia Department of Natural Resources, Wildlife Division; Natural Resources Conservation Service; Potomac Valley Chapter of the Audubon Society; Shepherdstown Volunteer Fire Department; and the National Park Service.

4.3 Tribal Consultation

None required.

4.4 Distribution of the Draft Environmental Assessment

The draft EA was available for public review and comment on November 24, 2010. The draft EA and its appendixes were posted on the NCTC website at http://nctc.fws.gov/EA. Postcards were mailed to the 246 members of the mailing list to notify them of the availability of the draft EA. Notices announcing the availability of the draft EA were published in the Shepherdstown Chronicle and Martinsburg Journal. The close of the comment period was December 30, 2010.

4.5 Distribution of the Final Environmental Assessment

This final EA is on the NCTC website at http://nctc.fws.gov/EA. Notices announcing the availability of this final EA were published in the Shepherdstown Chronicle and Martinsburg Journal.

Requests for a hardcopy of the final EA and the Finding of No Significant Impact can be emailed to the NCTC Land Manger at phil_pannill@fws.gov.

Chapter 5. Literature Cited and Acronyms

5.1 Literature Cited

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5.2 Acronyms

AQI—Air Quality Index

CEQ—Council on Environmental Quality

CFR—Code of Federal Regulations

EA—environmental assessment

EPA—United States Environmental Protection Agency

F—Fahrenheit

FWS—United States Fish and Wildlife Service

IPM—Integrated Pest Management

NAAQS—National Ambient Air Quality Standards

NCTC—National Conservation Training Center

NEPA—National Environmental Policy Act

pm—particulate matter

ppm—parts per million

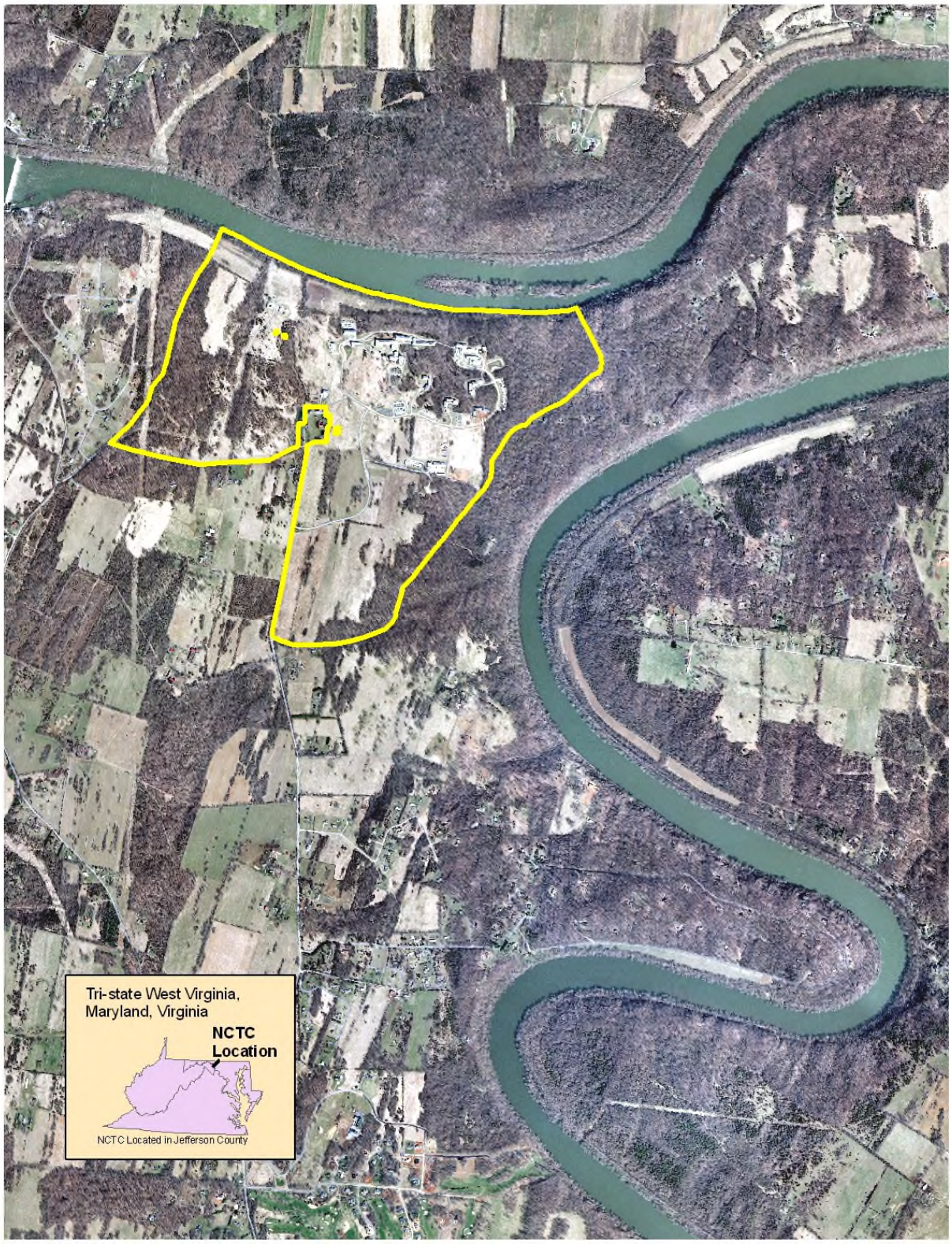
pH—potential of hydrogen

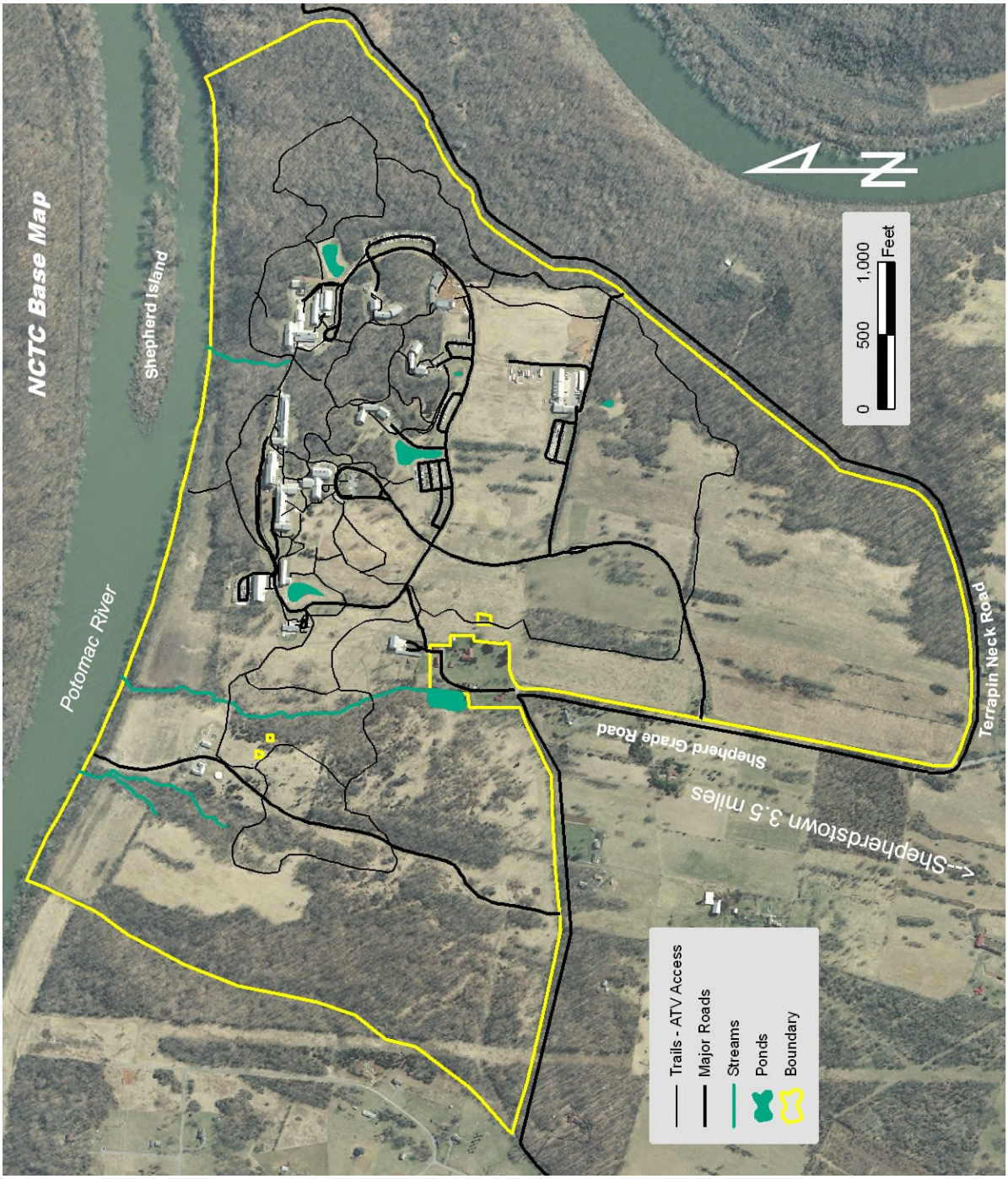
USC—United States Code

WVDEP–DAQ—West Virginia Department of Environmental Protection–Division of Air Quality

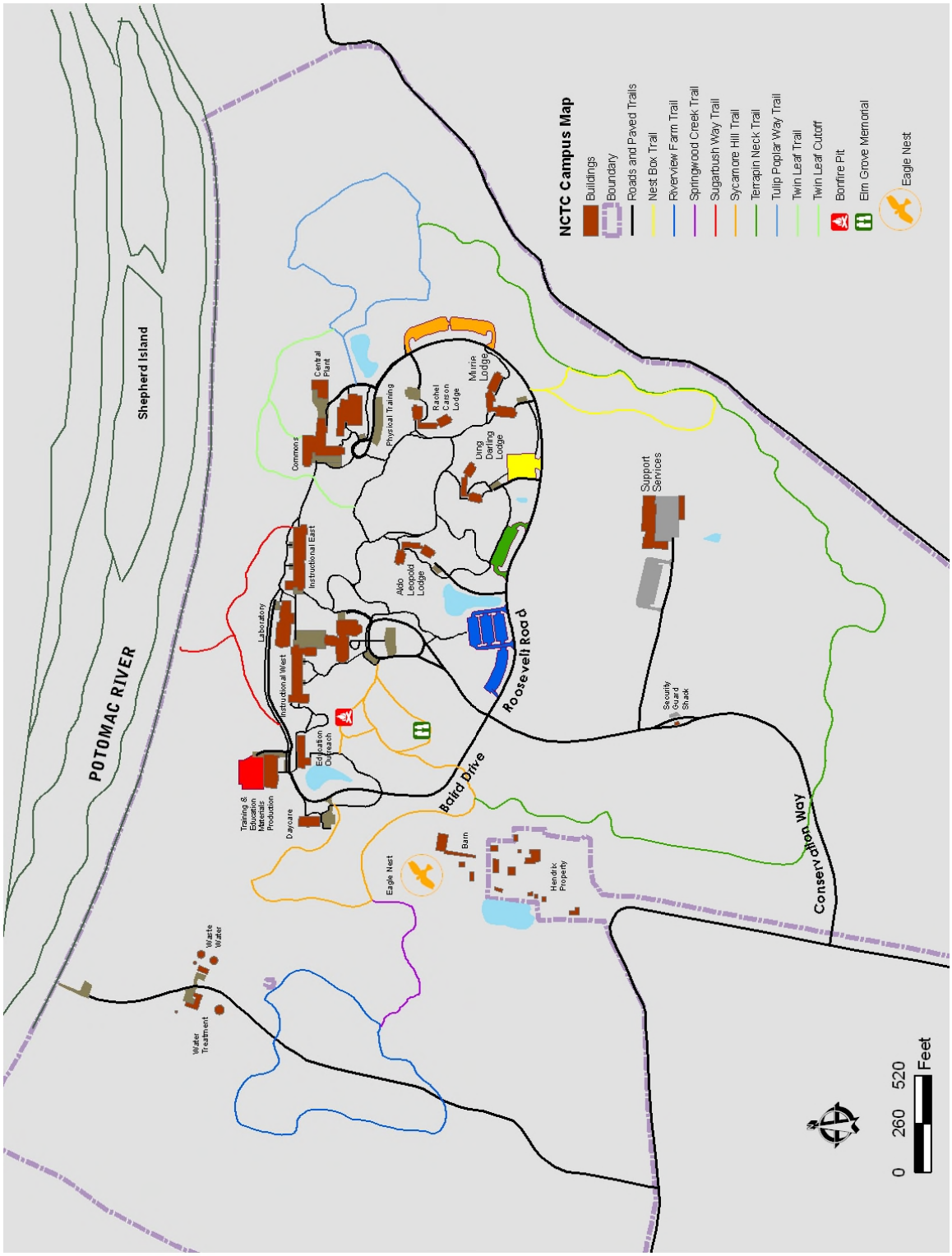
Appendix A: Maps

Map A-1. Vicinity map



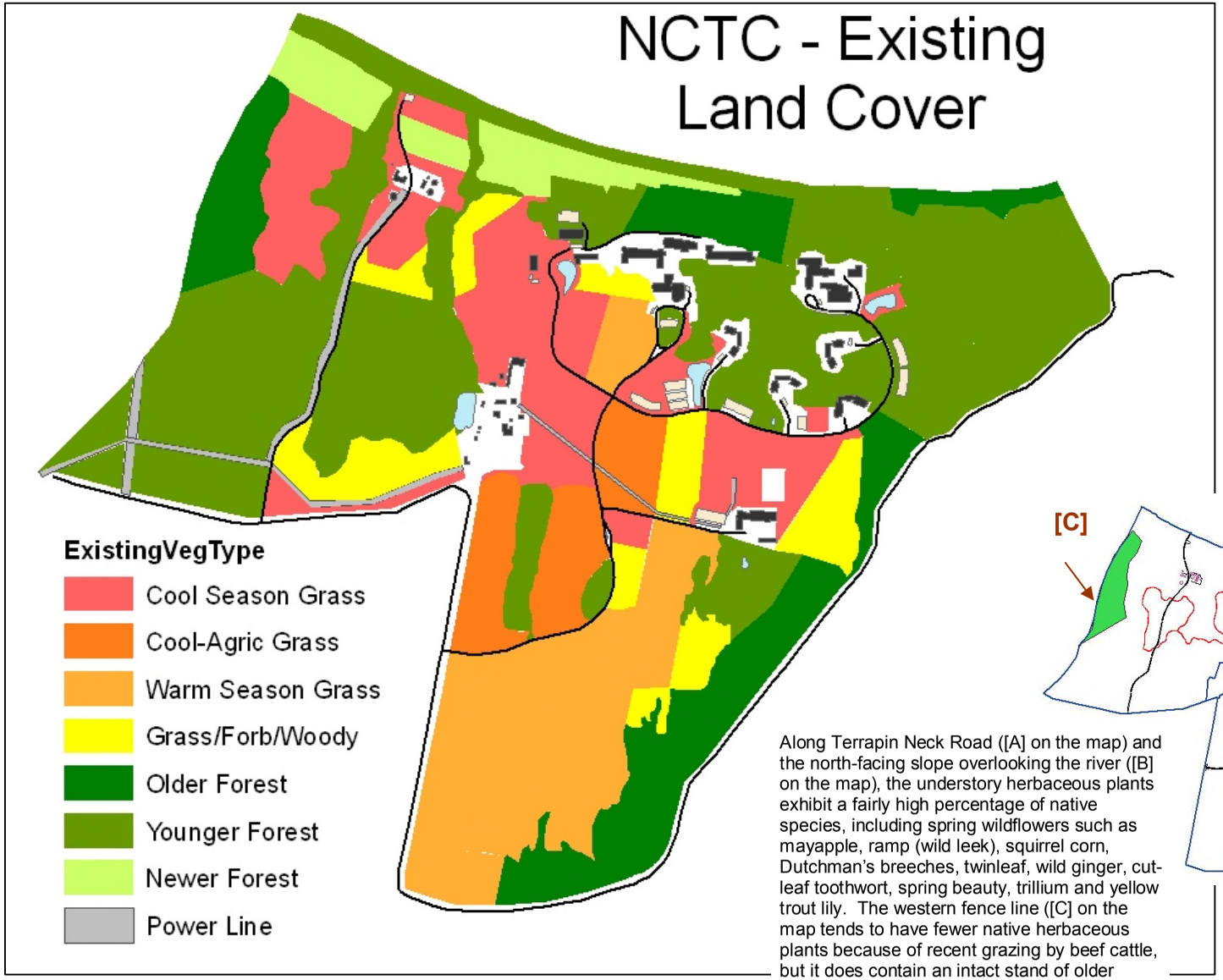


Map A-2. NCTC base map (2009)

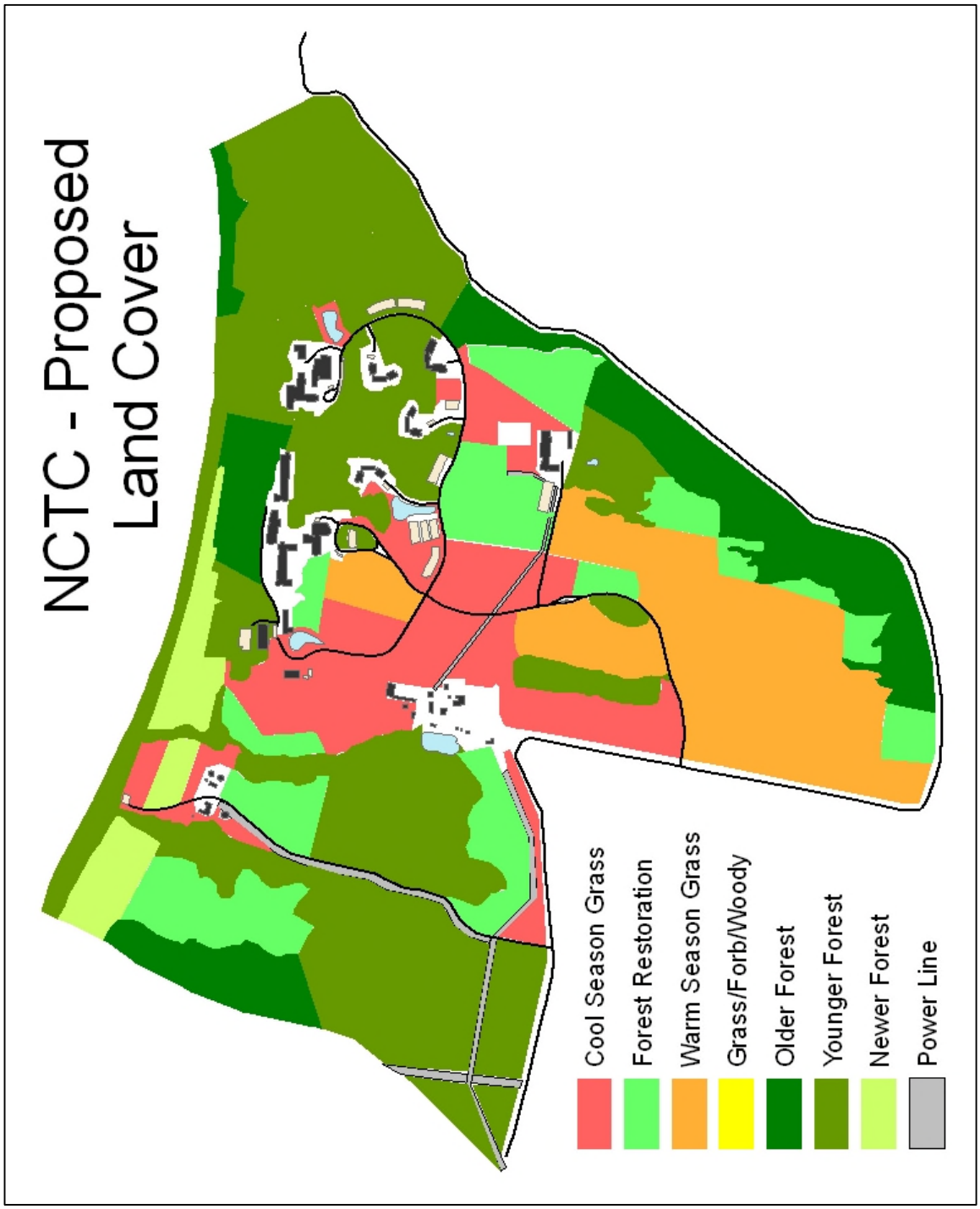


Map A-3. Campus map for the NCTC

Map A-4. Existing land cover at the NCTC

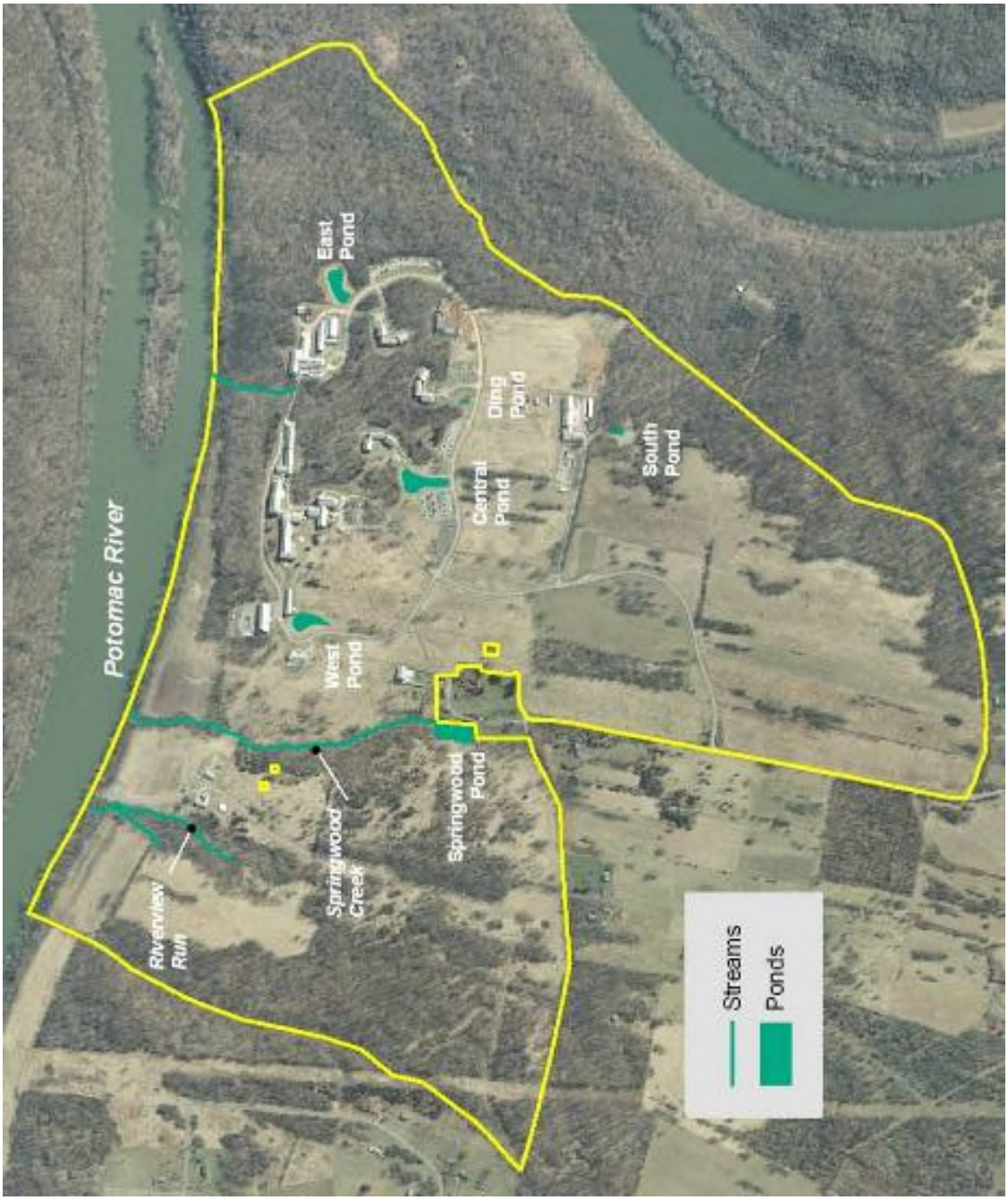


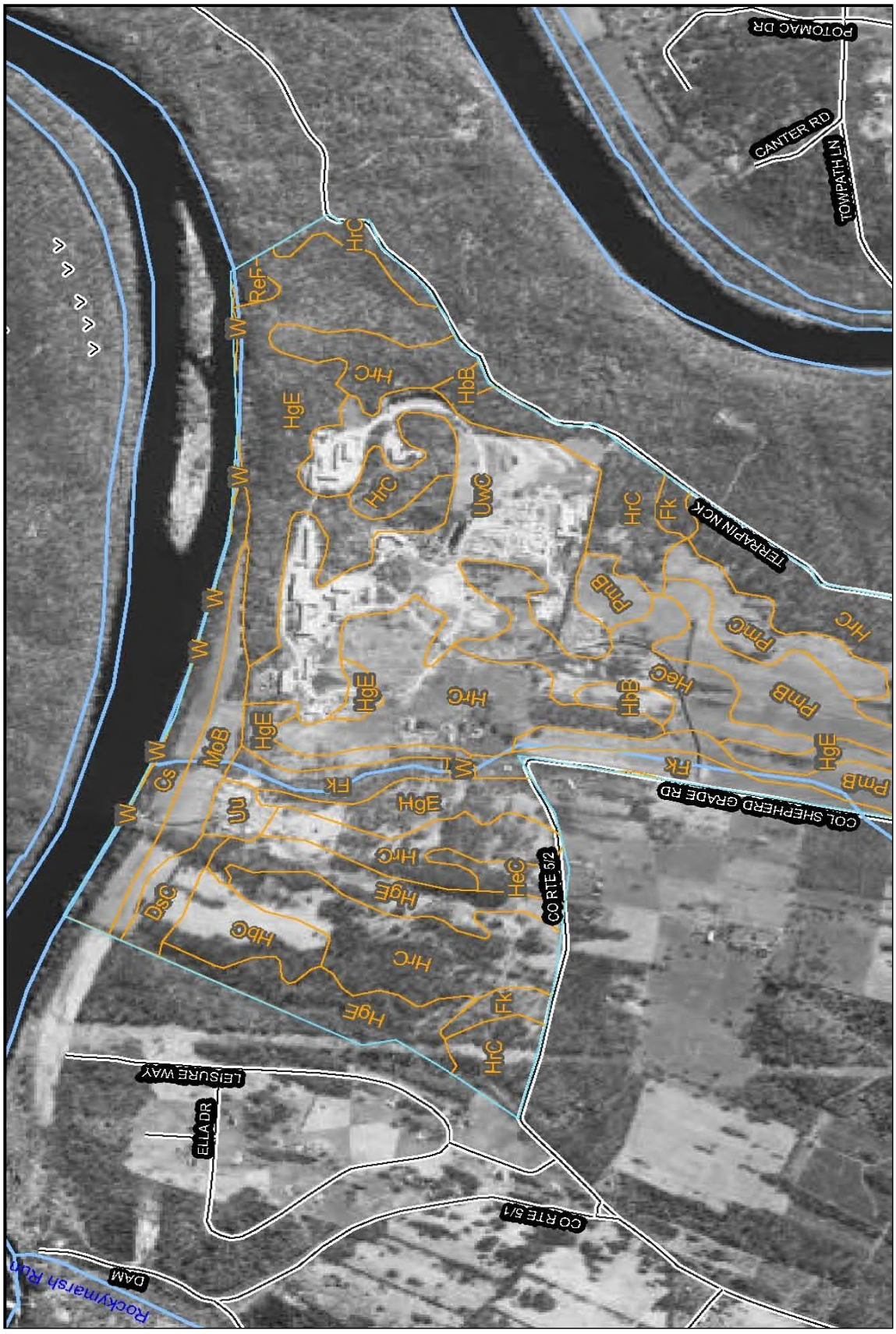
Along Terrapin Neck Road ([A] on the map) and the north-facing slope overlooking the river ([B] on the map), the understory herbaceous plants exhibit a fairly high percentage of native species, including spring wildflowers such as mayapple, ramp (wild leek), squirrel corn, Dutchman's breeches, twinleaf, wild ginger, cut-leaf toothwort, spring beauty, trillium and yellow trout lily. The western fence line ([C] on the map tends to have fewer native herbaceous plants because of recent grazing by beef cattle, but it does contain an intact stand of older beech trees.



Map A-5. Proposed land cover at the NCTC

Map A-6. Riparian and wetland areas at the NCTC.
(The northern boundary of NCTC runs about 1 mile along the Potomac River.)





Map A-7. Soil map from Custom Soil Resource Report, Jefferson County, West Virginia

Appendix B: Species Accounts and Species Lists

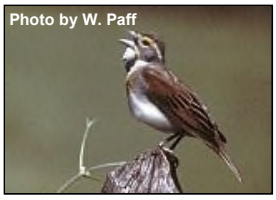
Species Accounts: Priority and Focal Wildlife Species

Grassland Habitat: Species Accounts

- **Loggerhead shrike (*Lanius ludovicianus)***—a passerine (perching songbird) that uses the grassland areas for breeding and migration. They nest in the mid-story of trees, and their exclusive food sources are insects, small mammals, and birds (USFWS 2010b). Loggerhead shrikes breed in open areas dominated by grasses and/or forbs, interspersed with shrubs or trees and bare ground. It is generally tolerant of people near its nest, although it will abandon nesting attempts if disturbed during egg-laying or early in incubation.

  The range of the loggerhead covers a broad area, but regardless of the geographic location, loggerhead shrikes are often found breeding in linear strips of habitat along roadsides because these areas frequently provide foraging areas (grass), perches (overhead wires, utility poles, fences), and nesting substrate (scattered trees/shrubs or fencerows) (DeGeus 1990 as referenced in USFWS 2010b and Esely n.d.). Loggerhead shrikes appear to occupy similar habitats in winter, although winter ecology of the species has not been thoroughly studied (USFWS 2010b). Temple (1995 as referenced in Esely n.d.) noted that many species of shrikes now occupy habitats that are essentially artificial, in that they have been created or extensively altered by human activities. Their year-round distribution includes the very eastern and northeastern sections of West Virginia (Buckelew and Hall 1994).

  The primary threats are degradation and loss of habitat due to development. The conservation measures are to increase the prevalence of medium and tall grasses through mowing and prescribed burning and maintaining brushy habitat along field edges and fence lines, scattered trees in pastures and fields, and hedges as potential nest sites (BNA 2010). Once widespread and common, the loggerhead shrike has experienced continentwide population declines—the continental population 40 years ago was approximately 10 million; today it is about 2.9 million. It is one of the most persistently declining species surveyed by the North American Breeding Bird Survey (BBS).



- **Dickcissel (*Spiza americana)***—uses the grassland areas for breeding and migration. It nests in grasslands, meadows, savanna, and hay fields. It prefers low-ground nest locations, and its nest is a bulky, loose cup of woven grass and leaves, usually placed in a grassy field. The diet of breeding adults is 70 percent insects and 30 percent seeds, while for young birds, it is the reverse: 70 percent seeds and 30 percent insects. Outside of the breeding season, Dickcissels feed mostly on seeds, including weed seeds and cultivated grains.

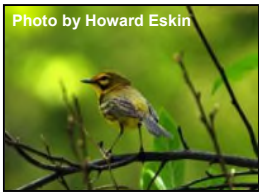
  This Neotropical migratory bird is well adapted to residing in agricultural landscapes, inhabiting hayfields, pastures, weedy fallow fields, and the weedy margins of ditches and roadsides. However, the conversion of these habitats into cultivated fields and the more frequent mowing of hayfields contributed to the declines in some areas (Fretwell 1986). The greatest threat to the Dickcissel comes when it is wintering in Venezuela where it gathers in enormous flocks and feeds on cultivated plants such as rice and sorghum. Venezuelan farmers have poisoned flocks, which can number over a million birds. A single "successful" poisoning event of a large flock of roosting birds could significantly reduce the world population of

Dickcissel (AS 2010). The Eastern BBS shows a steady decline from the 1960s to the mid-1990s. The BBS shows the relative average abundance in northern West Virginia as less than one (BBS 2003).

Shrub–Early Successional Habitat in Grassland Areas

- **American woodcock (*Scolopax minor*)**[a]—a species of forests and openings that uses the early shrub areas for breeding and migration. They breed across eastern North America from Atlantic Canada to the Great Lakes and spend the winter in lowlands mainly in the southern and Gulf Coast states. Their roosting habitats are semi-open sites with short, sparse plant cover, such as pastures. Its preferred habitat is a complex of open fields and clearings and wet woods and thickets, moving between the wooded areas during the day and the open areas at night (ABC 2010; USGS 2010a). Woodcocks mainly eat invertebrates, particularly earthworms, which they catch by probing in the soil with their long bills. Other items in their diet include insect larvae, snails, centipedes, millipedes, spiders, snipe flies, beetles, and ants, and a small amount of plant food is eaten, mainly seeds. They do most of their feedings in areas that are moist. Woodcocks are most active at dawn and dusk (BNA 2010).

  The woodcock is widespread in eastern North America. From 1966 to 2000, the Breeding Bird Surveys indicate its populations are declining at an annual rate of 1 percent. Most authorities attribute this decline to a loss of habitat caused by forest maturation and urban development (*ibid*.).



- **Prairie warbler (*Dendroica discolor*)**[a]—breeds in shrubby habitats, including those in southern pine forest, mangroves, pine and scrub oak barrens, and regenerating forest. Interestingly, the species has also been reported breeding in closed-canopy forests in Virginia. The prairie warbler eats mostly insects and spiders, but will also take mollusks and sometimes fruit and other vegetative matter. The cup-shaped nest, made of plant fibers and other materials, is placed in a shrub or sapling roughly 1 to 10 feet off the ground (AS 2010).

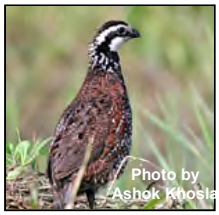
  The prairie warbler is a Neotropical migratory bird. Its fall migration begins in September, and the species returns to its breeding grounds beginning in March (AS 2010). Habitat loss and fragmentation are the two major threats. Habitat loss in the wintering range due to wood cutting, development, and agriculture may also be tied to this species' decline. Since the Prairie Warbler has a rather limited winter range, destruction that occurs there could devastate some local populations. A variety of management tools can be used to create or maintain shrubby, early successional habitats, including prescribed burns in fire-dependent habitats, mechanical removal of vegetation to mimic disturbance, and other activities (*ibid*.). It is among a suite of bird species of shrubby habitats that have shown some of the greatest declines of any habitat group (AS 2010). The BSS show recent declines in most of the bird's range.

- **Whip-poor-will (*Caprimulgus vociferus*)**—uses the shurb–early successional habitat for breeding and migration. It prefers dry, open woodlands (usually deciduous but also mixed or coniferous) with little underbrush. It feeds on night-flying insects, grasshoppers, and

mosquitoes, and forages primarily at dawn or dusk, but hunts for moths and beetles on moonlit nights (AS 2010). The whip-poor-will does not build a nest but instead lays its eggs on leaf litter on the forest floor. Eggs and chicks are very well camouflaged, and there are nearly always 2 eggs to a clutch. Second broods are very common, and hatching is correlated with the full-moon cycle, enabling parents to adequately provide for their offspring. Chicks are quite mature when hatched, and quickly leave their nest, thus protecting the brooding location from predators (*ibid*.).

Because this species prefers open woodlands, it depends on deliberate management to create and maintain habitat. Thus, fire suppression in eastern deciduous forests is a major cause of habitat loss. One conservation measure for meeting habitat requirements is deer management on government-owned lands to allow for the maintenance of forest understory plants (*ibid*.). The rate of decline for this species is 57 percent over the past 40 years, where the continental population was 2.8 million 40 years ago and is currently about 1.2 million. The Eastern BBS shows a steady decline from the 1960s to the mid-1990s. The BBS shows the relative average abundance in northern West Virginia as less than one (BBS 2003).

- **Northern bobwhite (*Colinus virginianus*)**—prefers grasslands mixed with shrubs or widely spaced trees—uses the shrub–early successional habitat for breeding and migration. It feeds primarily on seeds of agricultural crops and forest vegetation, especially from plants in the understory and along field edges. It feeds and moves in a covey (a group of 5 to 30 birds). The northern bobwhite builds its nests on the ground and has a high reproductive rate but also a high mortality rate. Females may lay up to 3 clutches in a season, each with 12-14 eggs, and the chicks are able to leave the nest about a day after hatching (AS 2010). It is a year-round resident in West Virginia.



Conservation measures include maintaining and restoring grassland areas; taking measures to stop the spread of nonnative/invasive plant species, such as annual grasses; mowing hayfields later in the season, such as early August; and promoting deer management that allows for the maintenance of forest understory plants (AS 2010). Today, the estimated continental population is about 5.5 million, whereas 40 years ago, it was 31 million—that is an approximate rate of decline of 82 percent over the past 40 years. The BBS shows the relative average abundance in northern West Virginia is between 0.5 and 1 (BBS 2003).

- **Field sparrow (*Spizella pusilla*)**—breeds in old fields, brushy pastures, woodland openings, edges, and second-growth scrub—it avoids similar habitat in developed areas. It winters in fields and forest edges. It is a year-round resident in northern West Virginia but is also a partial, short-distance migrant. It forages on the ground or low-lying vegetation and feeds primarily on seeds (mostly all from various grasses) and small quantities of insects. The nests are composed almost exclusively of grasses, are located near the ground in early spring, and are typically located at or near the base of woody vegetation. Later in the year the nests are build in small saplings and shrubs (about 3 feet in height or smaller) as ground cover increases in height (Carey et al. 2008; USGS 2010e).

Conservation measures include protecting existing prairie and successional habitats; avoiding practices that completely remove woody vegetation; burning to prevent the encroachment, but not removal, of woody vegetation; and removing the canopy and thinning shrubs and saplings on forested habitats. This species is not considered threatened, but their numbers are declining. The primary causes of the decline are changes to their breeding habitat as old fields are converted to forests or area cleared for agriculture or suburban growth. The species may have had greatest abundance in late 19th century, after felling of eastern forests and before increase in woodland, agriculture, and suburban development. Based on Breeding Bird Survey data, there were significant declines (3.2 percent per between 1966 and 2003) in breeding populations (Carey et al. 2008).

- **Eastern towhee (*Pipilo erythrophthalmus*)**—inhabits forest and swamp edges, pine barrens (such as the Albany Pine Bush), woodlands, regenerating clearcuts, power line rights-of-way, open woodlands with a well-developed understory, old fields, overgrown pastures and fencerows, riparian thickets, and other brushy habitats. The nest is either placed on the ground hidden among dense, woody vegetation or above the ground in a tangle of low shrubs or vines. It is built by the female and is a substantial cup made of grass, bark shreds, rootlets, and pieces of dead leaves. The towhee eats insects such as caterpillars, spiders, beetles, and ants, as well as snails and small salamanders, weed and grass seeds, acorns, small fruits, and berries. It typically forages on the ground in dense, low vegetation with leaf litter by scratching forward and back with both feet (Greenlaw 1996).


Photo by T. Gallagher/CLO

  Three greatest threats include loss of shrubland habitat due to forest succession and changes in agriculture practices and predation of eggs and nestlings by blue jays, foxes, domestic and feral cats, coyotes, snakes, skunks, raccoons, or other small mammals.. Conservation measures include implementing habitat management or enhancement activities that increase the amount of open-canopied shrubby habitats; creating open-canopied, shrubby secondary forests by thinning; using controlled burning regimens that favor shrubby understory vegetation. Throughout its range, the Eastern towhee has experienced major population declines during the past 30 years, particularly in the northeastern portion of the range (*ibid.).* However, it is not listed as rare, endangered, or threatened species for the state of West Virginia (WVDNR 2010) and is not found on the Audubon WatchList (Greenlaw 1996).

- **Blue-winged warbler (*Vermivora pinus*)**—chooses forest-field regions that are often shaded by large trees. The female places a nest on or near the ground at the base of berry bushes, goldenrods, and other shrubby plants and forbs., The female will build a round, sprawling, narrow, deep basket of dead leaves, grasses, and bark shreds in May and June. Incubation lasts 11 to 12 days, and the young fledge in about 10 days, leaving the nest within one hour of each other over a day or two. Its food choices have been poorly documented, but it likely eats beetles, moths, moth larvae, flies, bugs, grasshoppers, crickets, and spiders (AS 2010). The blue-winged warbler breeds in the eastern United States from southeastern Minnesota and southern Ontario south to Missouri, Arkansas, and Tennessee and winters along the Atlantic slope of Mexico and Central Mexico.


Photo by C. Robbins

Its greatest threat in the United States is suburban expansion, and in its wintering range, the threat is tropical deforestation (AS 2010). Conservation measures include managing for the needs of species inhabiting shrubby, early successional habitats. Management tools include such activities as prescribed burns in fire-dependent habitats and mechanical removal of vegetation to mimic disturbance (AS 2010). The BBS showed a 0.7 percent annual decline across the species range from 1966–2001.

Mixed-Deciduous Forests (MDF) Habitat: Species Accounts

The priority and focal (note "a") species found in mix-deciduous forest habitat are discussed below (refer to Table 3 above for a list of those species). The effects of land management actions in the forested areas at NCTC and the wildlife that inhabit those areas are also presented.

- **Cerulean warbler (*Dendroica cerulea)*[a]**—breeds in the eastern United States in mature deciduous forests with broken canopies. Tree size (both height and diameter) are of primary importance. It forages and nests higher in the tree canopy than other warbler species. Its nest is built on a lateral limb of a deciduous tree above an open area, and the nest is concealed from above by leaves or vines. The nest is constructed of finely woven grass, plant stems/fibers, tree bark, mosses, and lichens, and the entire structure is bound together on the outside with spider silk. It eats insects found on leaves and a small amount of plant material in the winter .

  The main threat to this Neotropical migratory songbird is from habitat loss and degradation in both its summer range and winter range (South America). The main threat is from habitat (particularly breeding) degradation and forest fragmentation, primarily from mountaintop mining in Appalachian forests and other forms of development, but also from loss of key tree species due to disease. Thus, the primarily conservation measure is to maintain forests, especially those with distinct canopy layers. Its winter habitat in South America is being destroyed for the production of coffee beans and coca as the demand for coffee and illegal cocaine-based drugs grows. Ceruleans have experienced one of the steepest declines of any warbler species, showing a decline of 4.5 percent per year from 1966–2001, according to the BBS (AS 2010).

- **Wood thrush (*Hylocichla mustelina*)[a]**—breeds in both the interior and edges of deciduous and mixed forests (often near water) in the eastern United States. It needs moderate to dense understory, shade, moist soil, and decaying leaf litter. This species will sometimes choose shrubby second-growth forests or even suburban parks in which to nest. It forages mainly on the forest floor, flipping leaves over with their bills to reveal insects. They eat a wide variety of invertebrates, including beetles, ants, moths, caterpillars, millipedes, and small crustaceans. They also feed on fruits and berries (AS 2010).

  The main threat to this Neotropical migratory songbird is from increased forest fragmentation of its breeding grounds and a higher rate of nest predation and cowbird brood parasitism, which decreases reproductive success. The wood thrush has become a species of conservation concern, and in the process, it has been established as a symbol of the decline of Neotropical songbirds in the forests of eastern North America. This species, along with many others, faces

threats on both its North American breeding and Neotropical wintering grounds. The continuing destruction of primary forest in Central America eliminates preferred wood thrush wintering habitat, most likely forcing birds to attempt to exist in secondary habitats where mortality rates may be higher. Across the wood thrush's entire range, the BBS data from 1966 to 1994 show a decline of 1.7 percent per year (AS 2010).

- **Kentucky warbler (*Oporornis formosus*)**—nests primarily in deep, deciduous moist woodlands with well-developed ground cover. The female builds her well-concealed open-cup nest with coarse grasses and oak leaves in dense understory just above the ground often on a slope, and the nests are typically anchored to a small shrub. Its diet consists of insects, caterpillars, and small spiders during the breeding season (AS 2010).

  A major threat to this Neotropical migratory songbird is the loss of bottomland hardwood forests and habitat degradation (often a complete loss of understory vegetation) by an over-abundant white-tailed deer population. The warbler's winter range is on the Yucatan Peninsula and the many islands of the Caribbean, flying nonstop across the Gulf of Mexico. The BBS data show a statistically significant 1 percent per year decline between 1966 and 2001 across its entire United States range (AS 2010).

- **Eastern screech owl (*Megascops asio*)**—inhabits open woodland, deciduous forest, orchards, woodlands/forest edges, swamps, parklands, residential areas in towns, scrub, and riparian woodland in drier regions. Roosts in tree hollow, among foliage close to trunk, in rock crevice, nest box, under eaves, or similar sites. It hunts from dusk to dawn, with most hunting being done during the first four hours of darkness. They hunt mainly from perches, occasionally hovering to catch prey. Forages on an extremely wide range of prey such as small mammals, large flying insects, many species of small songbirds and even larger birds (such as northern bobwhite, rock dove, and ruffed grouse), small fish, and small reptiles and amphibians (NatureServe 2010; TOP 2010).

  The eastern screech owl covers the majority of the eastern United States, and although it is one of the most familiar North American birds, it is poorly studied.The BBS and Christmas Bird Survey both show a relative average abundance in northern West Virginia at less than one (BBS 2003). The owl is not on the Audubon Society WatchList nor is it shown as having declining populations.

- **Chimney swift (*Chaetura pelagica*)**— nests in scattered hollow trees in mature forests, artificial chimneys, and inside old buildings. They feed primarily on insects. Chimney swifts spend winter months in the upper Amazon basin of Peru, Ecuador, Chile, and Brazil, and little is known of their biology while they are there. When they return to North America in March or April as flocks, pairs of birds soon break away to individual nest sites in chimneys or the walls of abandoned buildings. There, the pair builds a nest of loosely woven twigs, cemented together and to the wall of the chimney with the bird's glue-like saliva. Much of the life history of the chimney swift remains

unknown, primarily because so much of this bird's day is spent in wide-ranging, fast flight and its nesting and roosting occur in dark, largely inaccessible chimneys and widely scattered tree cavities.

Before European settlement of North America, the chimney swift probably nested in caves and hollow trees. The swift benefited greatly by the construction of chimneys and the increased availability of new nest sites. Recent changes in chimney design, with covered, narrow flues, have decreased the available nest sites and may be a factor in declining population numbers; however, its conversation status is listed as "least concern" (CLO 2010).

- **Prothonotary warbler (*Protonotaria citrea*)**—the only eastern United States warbler to nest in cavities. High quality breeding habitat is characterized by the presence of dead snags and cavity trees within riparian corridors, wooded swamps, and bottomland hardwood forests near flowing or standing water (NatureServe 2010). It eats insects and spiders, probing bark crevices, rolled leaves, and tangles. It occasionally takes fruits or nectar (*ibid.).* Since old-growth forests are more likely to contain cavity trees, loss of mature habitat poses a significant threat.

  The prothonotary warbler has become a relatively popular study species, and may be a useful indicator species for environmental quality of forested wetlands. Although the species has been studied fairly well in breeding areas, information about effects of habitat loss on migrating and wintering populations is currently lacking and is critical for future conservation and management of the species. Knutson et al. (1996) suggests conservation efforts focus on restoration of a variety of riparian forest types along small headwater streams and large riparian systems. The warbler's population numbers are fairly stable but with some indications of a small decline (NatureServ 2010).

- **Acadian flycatcher (*Empidonax virescens*)**—inhabits relatively undisturbed mature, moist deciduous forests generally near a stream such as shaded ravines, riparian woodlands, and wooded swamps. It requires a high dense canopy and an open under story. It tends to be scarce or absent in small forest tracts, unless the tract is near a larger forested area. Floodplain forests must be more than 400-500 feet wide before they become suitable. The minimum forest area needed to sustain a viable breeding population is 80 to 125 acres. They forage on a wide range of insect prey, including deer flies and mosquitoes, as well as other arthropods. They forage by gleaning the undersurfaces of leaves and by capturing insects in the air and occasionally on the ground. The nest is a shallow, loose, flimsy-looking cup made of fine dry plant stems, plant fibers, tendrils, and catkins held together with spider silk. The nest is placed, hammock-like, in a fork of the lower branches of a small tree, generally 8 to 20 feet above the ground (Whitehead and Taylor 2002).

  The primary threats are habitat loss and degradation and forest fragmentation. Management recommendations include conserving and maintaining large contiguous forest of at least 80 to 125 acres. The BBS data suggest that populations of the Acadian flycatcher are relatively stable, although the species is area-dependent and sensitive to forest fragmentation (*ibid.).*

- **Scarlet tanager (*Piranga olivacea*)**—breeds in deciduous forest and mature deciduous woodland, including deciduous and mixed swamp and floodplain forests and rich moist upland forests; prefers oak trees. Nests less frequently in mixed forest. Its most common in areas with a relatively closed canopy, a dense under story with a high diversity of shrubs, and scanty ground cover; able to breed successfully in relatively small patches of forest. Also sometimes nests in wooded parks, orchards, and large shade trees of suburbs. Its nest is a small, loose, flat saucer-shaped nest of twigs, rootlets, coarse grass, and weed stems, and the next is lined with finer grasses, weed stems, or pine needles. The nest is placed well out on a limb, anywhere from 20 to 35 feet above the ground. Its diet includes moths, bees, caterpillars, larvae of gall insects, beetles, crane flies, and most stages of gypsy moths, as well as fruit (CLO 2010).

  The scarlet tanager is a long-distance Neotropical migratory bird, annually making the journey between northwestern South America and the eastern United States and southern Canada. In eastern North America, its breeding range closely corresponds to the boundaries of the eastern deciduous forests. As a species of the forest interior, it is sensitive to forest degradation and fragmentation. It is subject to nest predation by skunks, raccoons, squirrels, and chipmunks, as well as domestic and feral cats. Conservation measures include minimizing the creation or presence of edge habitats, establishing forested corridors to reduce isolation of small patches, maintaining structural and plant species' diversity within existing forests, and not disturbing forest canopies during the breeding season. The Scarlet Tanager is considered a moderate conservation priority by Partners-in-Flight throughout the Appalachian region. According to the BBS, this species has declined significantly during the past 30 years in parts of the Appalachian region, including the Allegheny Plateau and Blue Ridge Mountains; however, it has increased significantly in the Ridge and Valley and Cumberland Plateau areas (CLO 2010).

- **Louisiana waterthrush (*Seiurus motacilla*)**[a]—breeds in deciduous and mixed-bottomland forests with a thick understory along clear, fast-flowing, gravelly streams. Robbins (1979) considered it to be area-sensitive species, requiring a minimum of 250 acres to sustain a viable breeding population in Maryland. Its territory is linear, running along streams, and was found by Eaton (1958) to be 1,312 feet in length. It nests on the ground along stream banks, hidden in the underbrush, or among the roots of fallen trees, in crevices or raised sites in tree roots, or in rock walls of ravines over water (NatureServe 2010).The nest is built by both adults and is a cup made of leaves, bark strips, twigs and moss placed on the ground in a cavity under a steep bank along streams or in upturned roots of a fallen tree over or near water (AS 2010). Its it feeds on a variety of insects such as caddis fly, midges, beetles, fireflies, stoneflies, and millipedes.

  The primary threats to this Neotropical migratory bird are forest destruction and fragmentation and nest predation by snakes, shrews, red squirrels, Blue Jays, raccoons, and opossums (AS 2010; BNA 2010). Conservation measures include preserving forest tracts over 250 acres in size and minimize edges, managing forests to create or maintain a dense understory of shrubs and saplings, and maintain the understory by limiting over browsing by white-tailed deer through herd culling or other methods (AS 2010; BNA 2010).

- **Nashville warbler (*Vermivora ruficapilla ruficapilla*)**—breeds in open mixed woods and bog habitats, but its ability to breed in a variety of second-growth habitats makes it a fairly common warbler throughout North America (BNA 2010). Its nest is a neat cup of mosses, strips of bark, leaves, pine needles, and grasses, and the top of the cup is often bordered with moss. The nests are well hidden, usually under bushes or among grasses, leaves, or mosses, and occasionally the nest is placed against the trunk of a tree, beneath or next to a log, or in sphagnum-moss hummock. Its diet includes insects such as flies, young grasshoppers, locusts, leaf-hoppers, many plant lice, caterpillars, most of which are taken when young and small, and also small wood-boring beetles (*ibid*.).

  Northern West Virginia is at the very southern extent of the warbler's eastern North American breeding range (*ibid*.). This Neotropical migratory bird winters in Texas, Mexico, and Central America. Threats include degradation of riparian habitat in their summer breeding areas and the cutting of forests and filling in of wetlands in their wintering habitat. As ground nesters, they are likely vulnerable to numerous predators, including owls and domestic cats (*ibid*.).

- **Worm-eating warbler (*Helmitheros vermivorus*)**—breeds in well-drained upland deciduous forests with understory patches of mountain laurel or other shrubs, drier portions of stream swamps with an understory of mountain laurel, deciduous woods near streams; almost always associated with hillsides. (CLO 2010). It is most abundant in mature woods but also may be common in young and medium-aged stands. Dense patches of shrubs or saplings may be an important component of territories. The nest, placed on a hillside or bank of ravine, is usually well hidden under a drift of dead leaves at base of a sapling, against roots of shrubs and trees, beside a rocky ledge or outcrop, or in dense low shrubs such as huckleberry and blueberry. This forest songbird is best known for its habit of hopping through the understory and probing into suspended dead leaves for food. Despite its name, the worm-eating warbler only rarely, if ever, eats earthworms. Instead, it feeds mostly on caterpillars (once referred to as "worms"), other insects, spiders, and slugs. Some data suggest that the bird chooses chestnut oaks for feeding early in the breeding season and then switches to understory shrubs in July (AS 2010).

  Forest fragmentation in its breeding grounds increases the bird's exposure to nest predation and cowbird parasitism, while deforestation of broadleaf forest on the species' wintering grounds in the Caribbean and Central America could also lead to population declines (AS 2010). Conservation measures include maintaining and restoring mature deciduous forests. The worm-eating warbler has been identified as a priority species in a number of Partners-in-Flight physiographic areas, including the Ohio Hills, Mid-Atlantic Ridge and Valley, and Northern Ridge and Valley areas (AS 2010).

- **Red-headed woodpecker (*Melanerpes erythrocephalus*)**—occupies a wide range of habitats, but most are characterized by open areas for feeding, snags for roosting, and a secure food supply. Requires multiple snags for nesting, roosting, and foraging. Some of the habitats used are open deciduous and riparian woodlands, orchards, parks, agricultural lands, savanna-like grasslands, beaver ponds with snags, forest edges, burned

forests, and flooded bottomland forests. Consumes seeds, nuts, sap, corn, fruit, insects, bird eggs, nestlings, adult birds, and mice. Eats mostly insects and plant material in summer and mostly nuts (acorns and beechnuts) in winter. Will forage on ground, capture insects in flight, glean food from vegetation, or chisel trees for wood-boring insects and sap. Most adapted of all the woodpeckers for flycatching (BNA 2010).

The threats include habitat degradation through cutting of snags, agricultural development, river channeling, regeneration of eastern forests, fire suppression, and loss of small orchards. Conservation measures include providing large forest fragments (greater than 200 acres) with large snags for nesting and open areas for catching flying insects. The BBS indicates a significant population decline of 2.5 percent per year from 1966 to 2000 and by 4.6 percent per year between 1980 and 2000. This has amounted to a 50 percent population reduction since 1966. Local population increases have been associated with increasing beaver populations and the creation of flooded forests with lots of snags for nesting. Controlled fires have both negative and positive impacts. While they open up the forest (providing open space for fly catching) and create snags, they can also destroy existing snags used for nesting.

- **Yellow-bellied sapsucker (*Sphyrapicus varius*)**—Breeds in open deciduous and mixed forests, including northern hardwoods, high-elevation spruce-fir, aspen groves, and some oak-hickory forests. Occurs in mature as well as secondary forests. It excavates cavities in snags or in living trees with rotten heartwood, including aspen, pine, birch, elm, butternut, cottonwood, alder, willow, beech, maple, and fir. May use the same nest tree for several years, but excavates a new cavity each year. These birds drill holes in trees and eat the sap and insects drawn to it. They may also pick insects from tree trunks or catch them in flight. They also eat fruit and berries (BNA 2010).

It is of moderate conservation importance because of its low overall density and dependence on snags and appropriate trees for nesting. As a primary cavity nester throughout the northern hardwood and Appalachian forests, this species is important for supplying nest sites for many other forest species. They leave their summer range and migrate to the southeastern United States, West Indies, and Central America. Their overall populations appear to be stable or increasing, but the distinctive birds of the high Appalachians are of local conservation concern (BNA 2010).

Riparian/Wetland Habitat: Species Accounts

- **American black duck (*Anas rubripes*)**[a]—breeds in a variety of North American wetlands, including freshwater wetlands created by beavers; brooks lined by speckled alder; land lakes, ponds, and bogs throughout mixed-hardwood and northern temperate (boreal) forests. They can be found year-round in West Virginia. It begins nesting in February in southern parts of its range, but often not until late May in northern parts. Its nests are usually well concealed and on the ground, often in uplands. It eats larvae of mayflies, caddis flies, dragonflies, true flies and also small crustaceans, snails, and clams. It will eat seeds of bur reed, sedges, rice cut-grass, and pondweeds (BNA 2010).

Long-term population declines were once attributed to excessive hunting, but breeding pairs are increasing in their range where hunting limits are in place. Other threats include predation, loss and degradation of wetland habitat for breeding and wintering due to development, and declines in submerged aquatic vegetation, which affects associated invertebrates fed on by the American black duck (*ibid*.).

- **Green heron (*Butorides virescens*)**[a]—breeds in small wetlands in low-lying areas. It is a small, stocky wading bird that is common in wet spots across much of North America. The species is most conspicuous during dusk and dawn, and if anything, these birds are nocturnal, preferring to retreat to sheltered areas in daytime. They nest in forest and swamp patches over water or in plants near water. Nests are a platform of sticks, often in shrubs or trees, and sometimes on the ground (they prefer nesting in trees). They mainly eat small fish, frogs, and aquatic invertebrates but may take any invertebrate or vertebrate prey they can catch, including leeches and mice. It is one of the few tool-using birds—it commonly drops bait/lures (crusts of bread, insects, earthworms, twigs, or feathers) onto the surface of the water and grabs the small fish that are attracted (BNA 2010).

  The primary concern is conservation and management of wetlands—of all sizes, including small ones. Management of green heron populations has not been a major focus because most populations are stable or increasing (*ibid*.).

- **American bittern (*Botaurus lentiginosus*)**—habitat chiefly includes freshwater wetlands with tall, emergent vegetation, but sparsely vegetated wetlands occasionally, and tidal marshes rarely. Uncommonly nests in upland cover surrounding a wetland basin, provided that cover is not modified by agriculture. It builds nests among dense emergent vegetation over water 2–8 inches deep. When nesting in uplands, nests over dry ground among dense, tall (over 12 inches) herbaceous cover in grasslands. It nests often over water in standing cattails, bulrushes and sedges; less often on dry ground in fields. The nest becomes well hidden as surrounding vegetation grows, and nests are often accessed by well-beaten pathways. The bittern eat insects, amphibians, small fish and mammals, and crayfish (BNA 2010).

  The availability of suitable wetland breeding habitat within its range likely determines gross abundance because its entire life cycle depends on wetlands. The primary sources that influence population changes in the United States may be human activity, but weather can affect breeding; that is, drought conditions depleting wetlands and harsh winters increasing mortality. It is the loss of large emergent wetlands that has impacted this species the most; therefore, it is preservation of freshwater wetland habitats, particularly large (over 100 acres), shallow wetlands with dense growth of robust emergent vegetation, is the most urgent management need. Wetlands used for breeding also need to be protected from chemical contamination and siltation that harm the birds or their food supplies (*ibid*.).

- **Bank swallow (*Riparia riparia*)**—breeds primarily in lowland riparian areas along rivers, streams, lakes, and wetlands, in addition to bluffs above rivers and streams. Nesting colonies, which can range from 10 to almost 2,000 active nests, are also found in artificial sites such as

sand and gravel quarries and road cuts. It is an aerial feeder that takes flying or jumping insects (such as mayflies, bees, wasps, and stone flies) almost exclusively on the wing but will occasionally eat terrestrial and aquatic insects or larvae (BNA 2010).

This migratory passerine is one of the most widely distributed swallows in the world. Northern West Virginia is in the southern-most part of its breeding range in the northeastern United States. Generally, the bank swallow is quite tolerant of human disturbance in the general vicinity of colonies, as evidenced by its propensity to nest in active sand and gravel quarries (*ibid*.).

- **Upland chorus frog (*Pseudacris feriarum feriarum*)**—usually found near grassy ditches, flooded fields, and temporary wetlands. This small, secretive frog is rarely encountered outside the breeding season (which can begin as early as January and is usually complete by late April, depending on temperature and rain), but nonbreeding individuals can occasionally be seen in woodlands, weedy meadows, and swamps (DC 2010). The eggs are laid in clusters (which are attached to vegetation) of about 60 each, and a female lays about 1,000 eggs; the tadpole period lasts 2 to 3 weeks. It feeds on insects.

  This small frog species appears to be declining in some areas of West Virginia. Healthy populations once found in Monroe and Greenbrier counties have not been detected in recent years. The very eastern counties of the West Virginia are at the very edge of its range, while other states, such as Virginia, North Carolina, and Missouri, are completely within its range. One cause of habitat loss may be from new developments where roadside ditches and other ephemeral (temporary) pools are being drained or destroyed. It is listed as a species of concern in West Virginia and is on the West Virginia Natural Heritage Program's list of "Rare, Threatened, and Endangered Animals" (WVDNR 2010).

- **Eastern ribbon snake (*Thamnophis sauritus*)**—habitats include wet meadows, marshes, seasonally flooded prairies, bogs, ponds, swamps, and shallow slow streams; also hardwood hammocks and other wet or moist forest in some areas. Usually this snake is in or near vegetative cover (often shrubs or clumps of sedges or grasses) in sun-exposed sites along the edge of standing or flowing water; it climbs into low vegetation. Shelters include thick vegetation, muskrat lodges, or burrows, and hibernation sites are in burrows, ant mounds, underground on high ground (sometimes high on rocky slopes), or underwater. Its primary diet includes amphibians (such as small frogs and salamanders) and fishes, and most prey is obtained in water or on the ground near water, sometimes in vegetation (Nature Serve 2010; DC 2010). They are excellent swimmers and are most active during the daytime.

  This snake is not significantly threatened in most areas, but where it is declining, it is due to habitat destruction and degradation of shoreline vegetation; however, this likely pertains primarily to peripheral populations or areas where the species is naturally rare. It is permanent, year-round species where it is present in West Virginia. It is on the West Virginia Natural Heritage Program's list of "Rare, Threatened, and Endangered Animals" (WVDNR 2010).

- **Star-nosed mole (*Condylura cristata*)**— lives in wet lowland areas and habitats with moist soil. Like other moles, this animal digs shallow surface tunnels for foraging; often, these tunnels exit underwater. It is active day and night and remains active in winter, when it has been observed tunneling through the snow and swimming in ice-covered streams. The mole's most distinctive feature is a circle of 22 mobile, pink fleshy tentacles (containing about 22,000 minute touch receptors known as Eimer's organs) at the end of the snout, from which they derive their name. They are accomplished swimmers and divers and frequently forage in water for small fish and aquatic invertebrates, including insects, mollusks, and crustaceans. They use their receptors to identify food by touch (Wikipedia 2010; PBS 2010; WCC 2010).

  Its greatest threat is destruction of wetlands (PBS 2010). The mole is native to eastern North America, and its range extends from the Atlantic Ocean west to Manitoba and North Dakota and south to Ohio and Virginia and is also found along the Atlantic coast south to Georgia, as well as throughout the Appalachian mountains. It is on the West Virginia Natural Heritage Program's list of "Rare, Threatened, and Endangered Animals" (WVDNR 2010).

- **Bald eagle (*Haliaeetus leucocephalus*)**[a]—breeds in forested areas adjacent to large bodies of water, and the distance to water varies within and among populations. In some cases, distance to water is not as critical as the quality of the foraging area that is present. The quality of foraging areas is defined by diversity, abundance, and vulnerability of the prey base and structure of aquatic habitat, such as the presence of shallow water. A large, super-canopy nest tree provides good flight access to the nest and good visibility of the surrounding area. The size of the forest area holding the nest tree may be unimportant if the area is isolated from human development and disturbance. The bald eagle eats a great variety of aquatic and terrestrial mammals, including muskrats and hares, reptiles and amphibians, crustaceans, and a variety of birds, including many species of waterfowl, gulls, and even Great Blue Herons. It attempts to take most prey (such as fish, waterfowl, and small mammals) on the wing but success varies greatly. It will feed extensively on decaying fish, birds, and mammals wherever encountered at sites that provide disturbance-free access from the ground (BNA 2010).

  Humans once represented the single greatest cause of mortality, either directly through their actions (such as shooting, trapping, and poisoning) or indirectly due to developments (such as powerlines and other structures). Environmental contaminants can also be significant sources of mortality. Before it was banned in the early 1970s, DDT entered the food chain and caused a dramatic decline in the reproduction of eagles and other birds of prey (WVDNR 2010).

  On July 9, 2007, the USFWS classified the bald eagle as "recovered" when it officially removed the bald eagle from any federal listing under the *Endangered Species Act* in the lower 48 states, including West Virginia, which can now boast more eagle nests than at any time in the past (WVDNR 2010). The bald eagle, nonetheless, is on the West Virginia Natural Heritage Program's list of "Rare, Threatened, and Endangered Animals" (WVDNR 2010). The eagle nest at the NCTC is on the west side of the campus, about 85 feet high in a large sycamore tree, and is about 4 feet across and 2 feet deep, and probably weighs a few hundred pounds. The nest is made of branches and large sticks with a softer grass and leaf lining (visit http://outdoorchannel.com/Conservation/EagleCam.aspx).

- **Wood turtle (*Clemmys insculpta*)**—lives along permanent streams during much of the year, but in summer, it may roam widely overland and can be found in a variety of terrestrial habitats adjacent to streams, including deciduous woods, cultivated fields, and woodland bogs, and marshy pastures. All turtle locations are within 160–330 yards of streams used by the turtles. In winter wood turtles are found in streams and rivers where they mate under water, but they are mostly terrestrial during the summer. The eggs are deposited in the spring, and hatching occurs in about two to three months. Wood turtles are omnivores, feeding on insects, earthworms, caterpillars, mollusks, tadpoles, dead fish, and newborn mice, and invertebrates. They also have a strong preference for vegetable matter, including fruits, berries, tender leaves, and mushrooms (Nature Serve 2010).

  Many turtles are collected to be sold as pets—they are a favorite of collectors because these animals are very friendly and easy to care for (MU 2010). In West Virginia, wood turtles are only known to occur in the Eastern Panhandle (*ibid*.), and they are present year-round within its range. Conservation measures include protection of wooded stream corridors, nesting, feeding, basking, and overwintering sites. Overall, land preservation is currently less important than regulatory protection from commercial collection for the pet trade (Nature Serve 2010). On May 26, 1995, the USFWS announced a 90-day finding for a petition to list the wood turtle (under the *Endangered Species Act*) as a threatened species throughout its historic range. The USFWS found that the petition did not present substantial scientific or commercial information indicating that listing the turtle was warranted. It is, however, on the West Virginia Natural Heritage Program's list of "Rare, Threatened, and Endangered Animals" (WVDNR 2010).

NCTC WILDLIFE LISTS

Mammals

Common Name	Scientific Name	Common Name	Scientific Name
White-tailed deer	*Odocoileus virginianus*	Eastern mole	*Scalopus aquaticus*
Red fox	*Vulpes fulva*	White-footed mouse	*Peromyscus leucopus*
Gray fox	*Urocyon cinereoargenteus*	House mouse	*Mus musculus*
Bobcat	*Lynx rufus*	Eastern chipmunk	*Tamius striatus*
Black bear	*Ursus americanus* (rarely	Little brown bat	*Myotis lucifigus*
Coyote	*Canis latrans*	Big brown bat	*Eptesicus fuscus*
Long-tailed weasel	*Mustela frenata*	Red bat	*Lasiurus borealis*
Mink	*Mustela vison*	Hoary bat	*Lasiurus cinereus*
Gray squirrel	*Sciurus carolinensis*	Eastern pipistrelle bat	*Pipestrellus subflavus*
Eastern fox squirrel	*Sciurus niger*	Eastern cottontail rabbit	*Sylvilagus floridanus*
Striped skunk	*Mephitis mephitis*	American beaver	*Castor canadensis*
Common raccoon	*Procyon lotor*	River otter	*Lutra canadensis*
Virginia opossum	*Didelphus virginiana*	Deer mouse	*Peromyscus maniculatus*
Groundhog	*Marmota monax*	Eastern woodrat	*Neotoma floridana*
Masked shrew	*Sorex cinereus*	Meadow vole	*Microtus pennsylvanicus*
Common water shrew	*Sorex palustris*	Star-nosed mole	*Condylura cristata*
Hairy-tailed mole	*Parascalops breweri*	Eastern cottontail	*Silvilagus floridanus*

Birds

The bird list below was compiled with the help of NCTC personnel, local master naturalists, and the Potomac Valley Audubon Society. The NCTC extends special thanks to Carol Del-Colle for her persistent hard work and expertise in creating this list.

Key to Relative Abundance by Season

A = abundant, very numerous
C = common, likely to be seen or heard in suitable habitat
U = uncommon, present but not certain to be seen
O = occasional, seen only a few times during a season
R = rare, may be present but not every year
* Indicates birds known to nest, or have nested, on or near NCTC

	Relative Abundance by Season			
	Spring Mar – May	Summer Jun – Aug	Fall Sep – Nov	Winter Dec – Feb
Loons				
Common loon	R		R	R
Grebes				
Pied-billed grebe	U		U	O
Horned grebe	O		U	R
Red-necked grebe				R
Bitterns and Herons				
American bittern	R			
Great-blue heron	C	C	C	C
Great egret	R			

	Relative Abundance by Season			
	Spring Mar – May	**Summer Jun – Aug**	**Fall Sep – Nov**	**Winter Dec – Feb**
Green heron*	C	C	U	
Swans, Geese, and Ducks				
Tundra swan	O			O
Canada goose*	C	C	C	C
Wood duck*	C	U	U	U
American wigeon	O			O
Gadwall	O			O
Green-winged teal	R		R	
Mallard*	C	C	C	C
American black duck	U	U	U	U
Blue-winged teal	R			R
Redhead			R	
Ring-necked duck	U		R	R
Greater scaup	R			R
Lesser scaup	U		O	R
Long-tailed duck	R			
Common goldeneye	O			O
Bufflehead	U		U	O
Hooded merganser	U		O	U
Common merganser	U		U	U
Red-breasted merganser				O
Ruddy duck	R		R	
Vultures, Hawks, and Falcons				
Turkey vulture	C	C	C	C
Black vulture	C	U	C	C
Osprey	U	O	U	
Bale eagle*	U	O	U	U
Sharp-shinned hawk	O	O	U	R
Cooper's hawk	O	O	U	R
Broad-winged hawk	R	O	U	
Red-shouldered hawk*	U	U	U	U
Red-tailed hawk*	C	C	C	C
American kestrel*	U	O	U	U
Grouse, Quail, and Turkey				
Wild turkey*	U	U	U	U
Rails and Coots				
American coot	O		U	O
Plovers and Sandpipers				
Killdeer*	C	C	U	O
Solitary sandpiper	U	U	O	
Spotted sandpiper	U	U	O	
American woodcock	R			

	Relative Abundance by Season			
	Spring Mar – May	Summer Jun – Aug	Fall Sep – Nov	Winter Dec – Feb
Gulls and Terns				
Bonaparte gull	R			
Ring-billed gull	U		O	O
Herring gull	R			O
Pigeons and Doves				
Rock pigeon	C	C	C	C
Mourning dove*	C	C	C	C
Cuckoos				
Yellow-billed cuckoo	U	U		
Black-billed cuckoo	O			
Owls				
Eastern screech owl	O	O	O	O
Great horned owl	C	O	O	R
Barred owl*	U	U	U	U
Northern saw-whet owl	R		R	
Goatsuckers				
Common nighthawk	U		U	
Whip-poor-will	R			
Swifts				
Chimney swift	C	C	C	
Hummingbirds				
Ruby-throated hummingbird*	U	U	U	
Kingfishers				
Belted kingfisher	C	C	C	O
Woodpeckers				
Red-bellied woodpecker*	C	C	C	C
Yellow-bellied sapsucker	R		U	U
Downey woodpecker*	C	C	C	C
Hairy woodpecker*	U	U	U	U
Northern flicker*	C	C	C	C
Pileated woodpecker*	C	C	C	C
Flycatchers				
Eastern wood-pewee*	C	C	U	
Willow flycatcher*	U	U		
Acadian flycatcher*	C	C	O	
Eastern phoebe*	C	C	U	R
Great crested flycatcher*	U	C		
Eastern kingbird*	C	C		
Larks				
Horned lark		O		
Swallows				
Purple martin	O	O		

	Relative Abundance by Season			
	Spring Mar – May	**Summer Jun – Aug**	**Fall Sep – Nov**	**Winter Dec – Feb**
Tree swallow*	C	C	U	
Bank swallow	O	R	O	
Northern rough-winged swallow	O	O	O	
Barn swallow*	C	C	C	
Crows and Jays				
Blue jay*	C	C	C	C
American crow*	C	C	C	C
Fish crow	U	C	O	R
Common raven	O	O	O	O
Chickadees and Titmice				
Black-capped chickadee			R	R
Carolina chickadee*	C	C	C	C
Tufted Titmouse*	C	C	C	C
Nuthatches				
Red-breasted nuthatch	R			R
White-breasted nuthatch*	C	C	C	C
Creepers				
Brown creeper	U		U	U
Wrens				
Carolina wren*	C	C	C	C
House wren*	U	U	O	
Winter wren	R			O
Kinglets and Gnatcatchers				
Golden-crowned kinglet	U	U	U	U
Ruby-crowned kinglet	O			R
Blue-gray gnatcatcher*	C	C		
Thrushes				
Eastern bluebird*	C	C	U	U
Hermit thrush	O			O
Wood thrush*	C	C	R	
American robin*	C	C	C	U
Mockingbirds and Thrashers				
Gray catbird*	C	C	O	
Northern mockingbird*	C	C	C	C
Brown thrasher*	C	C	O	
Waxwings, Shrikes, and Starlings				
Cedar waxwing	U	U	U	U
Loggerhead shrike			R	R
European starling*	C	C	C	C
Vireos				
White-eyed vireo*	C	C	O	

	Relative Abundance by Season			
	Spring Mar – May	**Summer Jun – Aug**	**Fall Sep – Nov**	**Winter Dec – Feb**
Blue-headed vireo	O		O	
Yellow-throated vireo	O	O		
Warbling vireo	O	U		
Philadelphia vireo	R		R	
Red-eyed vireo*	C	C		
Wood Warblers				
Blue-winged warbler	O	O	O	
Tennessee warbler	O		O	
Nashville warbler	O		O	
Northern parula*	U	U		
Yellow warbler*	U	U		
Chestnut-sided warbler	O		O	
Magnolia warbler	O		O	
Cape May warbler	O		O	
Black-throated blue warbler	O		O	
Yellow-rumped warbler	U		U	U
Black-throated green warbler	O		O	
Blackburnian warbler	O		O	
Yellow-throated warbler	U	U	O	
Pine warbler	U	U	U	
Prairie warbler	U	U		
Palm warbler	O		O	
Bay-breasted warbler	O		O	
Blackpoll warbler	O		R	
Cerulean warbler	O	O	O	
Black-and-white warbler	O		O	
American redstart	U	O	R	
Prothonotary warbler	O	O		
Worm-eating warbler	O		R	
Ovenbird	U	U	R	
Northern waterthrush	O		O	
Louisiana waterthrush	U	U	U	
Mourning warbler	R		R	
Common yellowthroat*	C	C	U	
Wilson's warbler	O		O	
Canada warbler	R			
Yellow-breasted chat	O	O	O	
Tanagers				
Scarlet tanager*	C	U		
Cardinals and Grosbeaks				
Northern cardinal*	A	A	A	A
Rose-breasted grosbeak	O		O	
Indigo bunting*	C	C	O	

	Relative Abundance by Season			
	Spring Mar – May	**Summer Jun – Aug**	**Fall Sep – Nov**	**Winter Dec – Feb**
Sparrows				
Eastern towhee*	C	C	C	C
American tree sparrow			R	O
Chipping sparrow*	C	C	O	
Field sparrow*	U	U	U	O
Grasshopper sparrow	R	R		
Fox sparrow	O		O	
Song sparrow*	C	C	C	C
Lincoln's sparrow	R		R	
Swamp sparrow	U	U	U	O
White-throated sparrow	O			C
White-crowned sparrow	O			U
Dark-eyed junco	C	U	U	C
Blackbirds and Orioles				
Red-winged blackbird*	C	C	U	O
Eastern meadowlark	C	C	O	R
Common grackle*	C	C	C	O
Brown-headed cowbird*	U	U	U	U
Orchard oriole*	C	C		
Baltimore oriole*	C	C		
Finches				
American goldfinch*	C	C	C	C
Purple finch	O		O	R
House finch*	U	U	U	U
Pine siskin			R	
Old World Sparrows				
House sparrow*	C	C	C	C

Reptiles and Amphibians

Spotted salamander	*Ambystoma maculatum*
Valley and ridge salamander	*Plethodon hoffmani*
Northern dusky salamander	*Desmognathus brimleyorum*
Long-tailed salamander	*Eurycea longicauda*
Red-backed salamander	*Plethodon cinereus*
American toad	*Bufo americanus*
Fowler's toad	*Bufo woodhouseii*
Upland chorus frog	*Pseudacris triseriata feriarum*
Gray tree frog	*Hyla versicolor*
Green tree frog	*Hyla cinerea* (disjunct population)
Spring peeper	*Hyla crucifer crucifer*
Green frog	*Rana clamitans*
Pickerel frog	*Rana palustris*
Bull frog	*Rana catesbeiana*
Wood frog	*Rana sylvatica*
Snapping turtle	*Chleydra serpentina*
Eastern box turtle	*Terrapene carolina*

Eastern painted turtle	*Chrysemys picta picta*
Wood turtle	*Clemmys insculpta*
Black rat snake	*Elaphe obsoleta obsoleta*
Northern water snake	*Nerodia sipedon*
Northern black racer	*Coluber constrictor*
Eastern garter snake	*Thamnophis sirtalis*
Eastern ribbon snake	*Thamnophis sauritus sauritus*

Fish

Note: No fish have been recorded living in any of the ponds or small creeks on the property. The following list contains fish common to this section of the Potomac River.
*** = stocked fish**

Smallmouth Bass	*Micropterus dolomieu*
Largemouth Bass	Microptera salmoides
Common Carp	*Cyprinus carpio*
Quillback	*Carpiodes cyprinus*
Bluegill	*Lepomis macrochirus*
Redbreast Sunfish	*Lepomis auritus*
Pumpkinseed	*Lepomis gibbosus*
Green Sunfish	*Lepomis cyanellus*
Long-eared Sunfish	*Lepomis megalotis*
Rockbass	*Ambloplites rupestris*
American Eel	*Anguilla rostrata*
Channel Catfish	*Ictalurus punctatus*
Yellow Bullhead	*Ameiurus natalis*
Margined Madtom	*Noturus insignis*
Walleye*	*Stizostedion vitreum*
Muskelunge*	*Esox masquinongy*
Creek Chub	*Semotilus atromaculatus*
Fallfish	*Semotilus corporalis*
River Chub	*Nocomis micropogon*
Greenside Darter	*Etheostoma blenniodes*
Rainbow Darter	*Etheostoma caeruleum*
Fantail Darter	*Etheostoma flabellare*
Tesselated Darter	*Etheostoma olmstedi*
Central Stoneroller	*Campostoma anomalum*
Spotfin Shiner	Cyprinella spiloptera
Cutlips Minnow	*Exoglossum maxillingua*
Common Shiner	*Luxilus cornutus*
Golden Shiner	Notemigonus crysoleucas
Comely Shiner	*Notropis amoenus*
Spottail Shiner	*Notropis hudsonius*
Rosyface Shiner	*Notropis rubellus*
Bluntnose Minnow	*Pimephales notatus*
Blacknose Dace	*Rhinichthys atratulus*
Longnose Dace	*Rhinichthys cataractae*
Pearl Dace	*Margariscus margarita*
White Sucker	*Catostomus commersoni*
Northern Hogsucker	*Hypentelium nigricans*
Golden Redhorse Sucker	*Moxostoma erythrurum*
Shorthead Redhorse Sucker	*Moxostoma macrolepidotum*
Brook Trout*	*Salvelinus fontinalis*
Banded Killifish	*Fundulus diaphanus*
Yellow Perch	*Perca flavescens*

Invertebrates

(Note: invertebrates and aquatic macrophytes have not been recorded in great detail as yet, but NCTC is working on it – the list below is what there is thus far.)

Invertebrates Recorded by Alan Temple's Macroinvertebrate Ecology and Identification Course in 2002 and 2003:

Aquatic invertebates include Asiatic clam, *Corbicula fluminea* which is present in high numbers in the Potomac River. It is an invasive exotic that appeared in the mid-20th century, with old shells several inches deep on the edges of Shepherd Island. Native mussels from several genera are also found in the Potomac including L*ampsilis* and E*lliptio.*

Caddisflies (Collected by B. Bauer of BHE Environmental 5/26/99)

Protoptila palina
Cheumatopsyche campyla
Cheumatopsyche sordida
Hydropsyche hageni
Hydopsyche phalerata
Hydropsyche scalaris
Hydroptila spatulata
Oecetis inconspicua
Triaenodes injustus

Butterflies (Collected 1998, specimens curated at NCTC Lab Building)

(There are more than 20 additional species that could be commonly found here, so this list is not yet a representative sample of the butterflies of the area.)

Summerbrood Hairstreak	*Everes comyntas comyntas*
Great Spangled Fritillary	*Speyeria cybele cybele*
European Skipper	*Thymelicus lineola*
Clouded Sulphur	*Colias philodice philodice*
Peck's Skipper	*Polites peckius*
Orange Sulphur	*Colias eurytheme*
Meadow Fritillary	*Boloria bellona bellona*
Tawny Emporer	*Asterocampa clyton clyton*
Grey Hairstreak	*Strymon melinus humuli*
Silvery Checkerspot	*Chlosyne nycteis nycteis*
Pearl Crescent	*Phyciodes tharos*
Silver Spotted Skipper	*Epargyreus clarus*
Tiger Swallowtail	*Papilio glaucus*
Monarch	*Danaus plexippus*
Zebra Swallowtail	*Eurytides marcellus*

Other known butterfly species:

Mourning Cloak	*Nymphalis antiopa antiopa*
Red-spotted Purple	*Limenitis arthemus astyanax*
Spicebush Swallowtail	*Papilio troilus troilus*
Hackberry Butterfly	*Asterocampa celtis celtis*

Platyhelminthes
Turbellaria (flatworms)

Gastropoda
Pulmanata
Physidae (pond snails)

Prosobranchia
Pleuroceridae (pleurocerid snails)

Arachnida
Acariformes
Hydracarina (water mites)

Crustacea
Isopoda
Asellidae (aquatic sow bugs)
Amphipoda (scuds)

Bivalvia
Unionidae
Elliptio (native mussels)
Corbiculidae
Corbicula fluminea (Asian clam)

Insecta
Hemiptera
Corixidae (water boatmen)
Notonectidae (backswimmers)
Nepidae
Ranatra (water scorpions)

Insecta (continued)
Ephemeroptera
Isonichiidae
Isonychia (brushlegged mayflies)
Caenidae (small squaregill mayflies)
Ephemerellidae

Belostomatidae (giant water bugs)
Gerridae (water striders)
Coleoptera
Gyrinidae (whirligig beetles)
Elmidae (riffle beetles)
Dytiscidae (predaceous diving beetles)
Hydrophilidae (water scavenger beetles)
Psephidae (water pennies)
Odonata
Zygoptera
Calopterygidae (broadwinged damselflies)
Lestidae (spreadwinged damselflies)
Anisoptera
Gomphidae (clubtail dragonflies)
Aeshnidae (darner dragonflies)
Libellulidae (skimmer dragonflies)
Plecoptera
Perlidae (common stoneflies)
Perlodidae (perlodid stoneflies)
Drunella (spiny crawler mayflies)
Heptageniidae (flatheaded mayflies)
Potamanthidae (burrowing mayflies)
Megaloptera
Corydalidae
Corydalus (hellgrammites)
Trichoptera (caddisflies)
Protoptila
Cheumatopsyche
Hydropsyche
Hydroptila
Oecetis
Triaenodes
Diptera
haoboridae (phantom midges)
Culicidae (mosquitoes)
Simuliidae (blackflies)
Chironomidae (midges)

NCTC PLANT LISTS

Trees

Common Name	Genus	Species	Family	Native
Boxelder	*Acer*	*negundo*	Aceraceae	native
Sugar Maple	*Acer*	*saccharum*	Aceraceae	native
Silver Maple	*Acer*	*saccharinum*	Aceraceae	native
Black Maple	*Acer*	*nigrum*	Aceraceae	native
Tree of Heaven	*Ailanthus*	*altissima*	Simaroubaceae	exotic/nonnative
Paw-Paw	*Asimina*	*triloba*	Annonaceae	native
Sweet Birch	*Betula*	*lenta*	Corylaceae	native
River Birch	*Betula*	*nigra*	Corylaceae	native
Shagbark Hickory	*Carya*	*ovata*	Juglandaceae	native
Pignut Hickory	*Carya*	*glabra*	Juglandaceae	native
Bitternut Hickory	*Carya*	*cordiformis*	Juglandaceae	native
Hackberry	*Celtis*	*occidentalis*	Ulmaceae	native
Redbud	*Cercis*	*canadensis*	Leguminosae	native
Flowering Dogwood	*Cornus*	*florida*	Cornaceae	native
American Beech	*Fagus*	*grandifolia*	Fagaceae	native
Green Ash	*Fraxinus*	*pennsylvanica*	Oleaceae	native
White Ash	*Fraxinus*	*americana*	Oleaceae	native
Honey Locust	*Gleditsia*	*triacanthos*	Leguminosae	native
Black Walnut	*Juglans*	*nigra*	Juglandaceae	native
Red Cedar	*Juniperus*	*virginianus*	Cupressaceae	native
Tulip Poplar	*Liriodendron*	*tulipifera*	Magnoliaceae	native
Cucumber Tree	*Magnolia*	*acuminata*	Magnoliaceae	native
White Mulberry	*Morus*	*alba*	Moraceae	exotic/nonnative
Virginia Pine	*Pinus*	*virginiana*	Pinaceae	native
Pitch Pine	*Pinus*	*rigida*	Pinaceae	native
White Pine	*Pinus*	*strobus*	Pinaceae	native
Sycamore	*Platanus*	*occidentalis*	Platanaceae	native
Bigtooth Aspen	*Populus*	*grandidentata*	Salicaceae	native
Cottonwood	*Populus*	*deltoides*	Salicaceae	native
Black Cherry	*Prunus*	*serotina*	Rosaceae	native
Sweet Cherry	*Prunus*	*avium*	Rosaceae	exotic/nonnative
Wild Crabapple	*Pyrus*	*coronaria*	Rosaceae	native
Scarlet Oak (?)	*Quercus*	*coccinea*	Fagaceae	native
Chinquapin Oak	*Quercus*	*muhlenbergii*	Fagaceae	native
Red Oak	*Quercus*	*rubra*	Fagaceae	native
Chestnut Oak	*Quercus*	*prinus*	Fagaceae	native
Black Oak	*Quercus*	*velutina*	Fagaceae	native
White Oak	*Quercus*	*alba*	Fagaceae	native
Black Locust	*Robinia*	*pseudo-acacia*	Leguminosae	native
Sassafras	*Sassafras*	*albidum*	Lauraceae	native
Basswood	*Tilia*	*americana*	Tiliaceae	native
Slippery Elm	*Ulmus*	*rubra*	Ulmaceae	native
American Elm	*Ulmus*	*americana*	Ulmaceae	native

Shrubs

Common Name	Genus	Species	Family	Native
Prickly Gooseberry	*Ribes*	*cynosbati*	Saxifragaceae	native
Staghorn Sumac	*Rhus*	*typhina*	Anacardiaceae	native
Jetbead	*Rhodotypos*	*scandens*	Rosaceae	exotic/nonnative
Elderberry	*Sambucus*	*canadensis*	Caprifoliaceae	native
Multiflora Rose	*Rosa*	*multiflora*	Rosaceae	exotic/nonnative
Witch Hazel	*Hamamelis*	*virginiana*	Hamamelidaceae	native
Wild Hydrangea	*Hydrangea*	*arborescens*	Saxifragaceae	native
Spicebush	*Lindera*	*benzoin*	Lauraceae	native
Bladderpod	*Staphylea*	*trifolia*	Staphyleaceae	native
Autumn Olive	*Elaeagnus*	*umbellata*	Eleagnaceae	exotic/nonnative
Blackhaw	*Viburnum*	*prunifolium*	Caprifoliaceae	native
Tartarian Honeysuckle	*Lonicera*	*tartarica*	Caprifoliaceae	exotic/nonnative

Grasses

Common Name	Genus	Species	Family	Native
Colonial Bent Grass	*Agrostis*	*tenuis*	Poaceae	native
Broomsedge	*Andropogon*	*virginicus*	Poaceae	native
Big Bluestem*	*Andropogon*	*gerardi*	Poaceae	native
Little Bluestem*	*Andropogon*	*scoparius*	Poaceae	native
Sweet Vernal Grass	*Anthoxanthum*	*odoratum*	Poaceae	exotic/nonnative
Small Carp Grass	*Arthraxon*	*hispidus*	Poaceae	exotic/nonnative
Oats	*Avena*	*sativa*	Poaceae	exotic/nonnative
Side-oats Grama*	*Bouteloua*	*curtipendula*	Poaceae	native
Long-awned Wood Grass	*Brachyeletrum*	*erectrum*	Poaceae	native
Brome Grass	*Bromus*	*tectorum*	Poaceae	exotic/nonnative
Brome Grass	*Bromus*	*inermis*	Poaceae	exotic/nonnative
Bermuda Grass	*Cynodon*	*dactylon*	Poaceae	exotic/nonnative
Orchard Grass	*Dactylus*	*glomerata*	Poaceae	exotic/nonnative
Smooth Crabgrass	*Digitaria*	*ischaemum*	Poaceae	exotic/nonnative
Crabgrass	*Digitaria*	*sanguinalis*	Poaceae	exotic/nonnative
Barnyard Grass	*Echinochloa*	*crusgalli*	Poaceae	exotic/nonnative
Goose Grass	*Eleusine*	*indica*	Poaceae	exotic/nonnative
Wild Rye	*Elymus*	*villosus*	Poaceae	native
Canadian Rye	*Elymus*	*canadensis*	Poaceae	native
Virginia Wild Rye	*Elymus*	*virginicus*	Poaceae	native
Frank's Love Grass	*Eragrostis*	*frankii*	Poaceae	native
Tall Fescue	*Lolium*	*arundinaceum*	Poaceae	exotic/nonnative
Rattlesnake Mannagrass	*Glyceria*	*canadensis*	Poaceae	native
Fowl Mannagrass	*Glyceria*	*striata*	Poaceae	native
Bottlebrush Grass	*Elymus*	*hystrix*	Poaceae	native
White Grass	*Leersia*	*virginica*	Poaceae	exotic/nonnative
Rice Cutgrass	*Leerzia*	*orizoides*	Poaceae	exotic/nonnative
Italian Rye Grass	*Lolium*	*multiflorum*	Poaceae	exotic/nonnative
Perennial Rye	*Lolium*	*perenne*	Poaceae	exotic/nonnative

Common Name	Genus	Species	Family	Native
Two-flower Melica	*Melica*	*mutica*	Poaceae	native
Japanese Stilt Grass	*Microstegium*	*viminium*	Poaceae	exotic/nonnative
Wood Witch Grass	*Panicum*	*philadephicum*	Poaceae	native
Switch Grass*	*Panicum*	*virgatum*	Poaceae	native
Timothy	*Phleum*	*pratense*	Poaceae	exotic/nonnative
Phragmites	*Phragmites*	*communis*	Poaceae	native
Kentucky Bluegrass	*Poa*	*pratensis*	Poaceae	exotic/nonnative
Rye Grass	*Secale*	*cereale*	Poaceae	exotic/nonnative
Yellow Foxtail	*Setaria*	*glauca*	Poaceae	exotic/nonnative
Foxtail	*Setaria*	*faberii*	Poaceae	exotic/nonnative
Indian Grass*	*Sorghastrum*	*nutans*	Poaceae	native
Johnson Grass	*Sorghum*	*halapense*	Poaceae	exotic/nonnative
Dropseed	*Sporobolus*	*vaginiflorus*	Poaceae	native
Purpletop	*Tridens*	*flavum*	Poaceae	native
Wheat	*Triticum*	*aestivum*	Poaceae	exotic/nonnative

Note: * Denotes those grasses that were planted on about 26 acres in 1999 and now established.

Forbs

Common Name	Genus	Species	Family	Native
Velvet-leaf	*Abutilon*	*theophrasti*	Malvaceae	exotic/nonnative
Wingstem	*Actinomeris*	*alternifolia*	Asteraceae	native
Tall Agrimony	*Agrimonia*	*gryposepala*	Rosaceae	native
Garlic Mustard	*Alliaria*	*officinalis*	Cruciferae	exotic/nonnative
Meadow Garlic	*Allium*	*canadense*	Liliaceae	native
Wild Leek	*Allium*	*tricoccum*	Liliaceae	native
Green Amaranth	*Amaranthus*	*retroflexus*	Amaranthaceae	exotic/nonnative
Giant Ragweed	*Ambrosia*	*trifida*	Asteraceae	native
Ragweed	*Ambrosia*	*artemisiifolia*	Asteraceae	native
Common Pimpernel	*Anagallis*	*arvensis*	Primulaceae	exotic/nonnative
Rue-anemone	*Anemonella*	*thalictroides*	Ranunculaceae	native
Mayweed	*Anthemis*	*cotula*	Asteraceae	exotic/nonnative
Puttyroot	*Aplectrum*	*hyemale*	Orchidaceae	native
Indian Hemp	*Apocynum*	*cannabinum*	Apocynaceae	native
Wild Columbine	*Aquilegia*	*canadensis*	Ranunculaceae	native
Spreading Rockcress	*Arabis*	*patens*	Cruciferae	native (rare)
Rockcress	*Arabis*	*perstellatus*	Cruciferae	native (rare)
Smooth Rock Cress	*Arabis*	*laevigata*	Cruciferae	native
Burdock	*Arctium*	*minus*	Asteraceae	exotic/nonnative
Jack-in-the-Pulpit	*Arisaema*	*atrorubens*	Araceae	native
Mugwort	*Artemisia*	*vulgaris*	Asteraceae	exotic/nonnative
Annual Wormwood	*Artemisia*	*annua*	Asteraceae	exotic/nonnative
Wild Ginger	*Asarum*	*canadense*	Aristolochiacea	native
Green-flowered Milkweed	*Asclepias*	*viridiflora*	Asclepiadaceae	native
Common Milkweed	*Asclepias*	*syriaca*	Asclepiadaceae	native
Butterfly Weed	*Asclepias*	*tuberosa*	Asclepiadaceae	native

Common Name	Genus	Species	Family	Native
White Wood Aster	*Aster*	*divaricatus*	Asteraceae	native
Bushy Aster	*Aster*	*dumosus*	Asteraceae	native
Calico Aster	*Aster*	*lateriflorus*	Asteraceae	native
Lowrie's Aster	*Aster*	*lowrieanus*	Asteraceae	native
Short's Aster	*Aster*	*shortii*	Asteraceae	native
Small White Aster	*Aster*	*vimineus*	Asteraceae	native
Heath Aster	*Aster*	*pilosus*	Asteraceae	native
Wild Indigo	*Baptisia*	*tinctoria*	Leguminosae	native
Early Winter Cress	*Barbarea*	*verna*	Cruciferae	exotic/nonnative
Winter Cress	*Barbarea*	*vulgaris*	Cruciferae	exotic/nonnative
Larger Bur Marigold	*Bidens*	*leavis*	Asteraceae	native
Begger Ticks	*Bidens*	*frondosa*	Asteraceae	native
False Nettle	*Boehmeria*	*cylindrica*	Urticaceae	native
Tall Bellflower	*Campanula*	*americana*	Campanulaceae	native
Shepherd's Purse	*Capsella*	*bura-pastoris*	Cruciferae	exotic/nonnative
Hairy Bittercress	*Cardamine*	*hirsuta*	Cruciferae	native
Common Thistle	*Carduus*	*acanthoides*	Asteraceae	exotic/nonnative
Musk Thistle	*Carduus*	*nutans*	Asteraceae	exotic/nonnative
Blue Cohosh	*Caulophyllum*	*thalictroides*	Berberidaceae	native
Yellow Star Thistle	*Centaurea*	*solstitialis*	Asteraceae	exotic/nonnative
Brown Knapweed	*Centaurea*	*jacea*	Asteraceae	exotic/nonnative
Mouse-Ear Chickweed	*Cerastium*	*vulgatum*	Caryophyllaceae	exotic/nonnative
Celandine	*Chelidonium*	*majus*	Papaveraceae	exotic/nonnative
Turtlehead	*Chelone*	*glabra*	Scrophulariaceae	native
Lamb's-quarters	*Chenopodium*	*album*	Chenopodiaceae	exotic/nonnative
Skeleton-weed	*Chondrilla*	*juncea*	Asteraceae	exotic/nonnative
Ox-eye Daisy	*Chrysanthemum*	*leucanthemum*	Asteraceae	exotic/nonnative
Chicory	*Cichorium*	*intybus*	Asteraceae	exotic/nonnative
Black Cohosh	*Cimicifuga*	*racemosa*	Ranunculaceae	native
Enchanter's Nightshade	*Circaea*	*quadrisulcata*	Chenopodiaceae	native
Bull Thistle	*Cirsium*	*vulgare*	Asteraceae	exotic/nonnative
Canada Thistle	*Cirsium*	*arvense*	Asteraceae	exotic/nonnative
Spring Beauty	*Claytonia*	*virginica*	Portulacaceae	native
Horse-balm	*Collinsonia*	*canadensis*	Scrophulariaceae	native
Asiatic Dayflower	*Commelina*	*communis*	Commelinaceae	exotic/nonnative
Poison Hemlock	*Conium*	*maculatum*	Umbelliferae	exotic/nonnative
Cancerroot	*Conopholis*	*americana*	Orobanchaceae	native
Hare's-Ear Mustard	*Conringia*	*orientalis*	Cruciferae	exotic/nonnative
Hedge Bindweed	*Convulvulus*	*sepium*	Convulvulaceae	native
Lance-leaved Tickseed	*Coreopsis*	*lanceoloata*	Asteraceae	native
Yellow Corydalis	*Corydalis*	*flavula*	Fumariaceae	native
Honewort	*Cryptotaenia*	*canadensis*	Umbelliferae	native
Tarweed	*Cuphea*	*petiolata*	Lythraceae	native
Jimsonweed	*Datura*	*stramonium*	Solanaceae	native
Queen Anne's Lace	*Daucus*	*carota*	Umbelliferae	exotic/nonnative
Dwarf Larkspur	*Delphinium*	*tricorne*	Ranunculaceae	native

Common Name	Genus	Species	Family	Native
Cut-Leaved Toothwort	*Dentaria*	*laciniata*	Cruciferae	native
Tick-trefoil	*Desmodium*	*perplexum*	Leguminosae	native
Tick-trefoil	*Desmodium*	*paniculatum*	Leguminosae	native
Tick-trefoil	*Desmodium*	*glutinosum*	Leguminosae	native
Hoary Tick-Trefoil	*Desmodium*	*canascens*	Leguminosae	native
Deptford Pink	*Dianthus*	*armeria*	Caryophyllaceae	exotic/nonnative
Dutchman's Breeches	*Dicentra*	*cucullaria*	Fumariaceae	native
Squirrel Corn	*Dicentra*	*canadensis*	Fumariaceae	native
Shooting Star	*Dodecatheon*	*meadia*	Primulaceae	native
Indian Strawberry	*Duchesnea*	*indica*	Rosaceae	exotic/nonnative
Viper's Bugloss	*Echium*	*vulgare*	Boraginaceae	exotic/nonnative
Ellisia	*Ellisia*	*nyctelea*	Hydrophyllaceae	native
Purple-leaved Willow Herb	*Epilobium*	*coloratum*	Onagraceae	native
Northern Willow Herb	*Epilobium*	*glandulosum*	Onagraceae	native
Harbinger of Spring	*Erigenia*	*bulbosa*	Umbelliferae	native
Daisy Fleabane	*Erigeron*	*annuus*	Asteraceae	native
Horseweed	*Erigeron*	*canadensis*	Asteraceae	native
Common Fleabane	*Erigeron*	*philadelphicus*	Asteraceae	native
Daisy Fleabane	*Erigeron*	*strigosus*	Asteraceae	native
Trout Lily	*Erythronium*	*americanum*	Liliaceae	native
White Trout Lily	*Erythronium*	*albidum*	Liliaceae	native
Boneset	*Eupatorium*	*perfoliatum*	Asteraceae	native
Spotted Joe-Pye Weed	*Eupatorium*	*maculatum*	Asteraceae	native
White Snakeroot	*Ageretina*	*altissima*	Asteraceae	native
Mistflower	*Conoclinium*	*coelestinum*	Asteraceae	native
Late Flowering Thoroughwort	*Eupatorium*	*serotinum*	Asteraceae	native
Cyperus Spurge	*Euphorbia*	*cyparissias*	Euphorbiaceae	exotic/nonnative
Spotted Spurge	*Euphorbia*	*maculata*	Euphorbiaceae	exotic/nonnative
False Mermaid Weed	*Floerkea*	*proserpinacoides*	Limnanthaceae	native
Woodland Strawberry	*Fragaria*	*vesca*	Rosaceae	exotic/nonnative
Galinsoga	*Galinsoga*	*ciliata*	Asteraceae	exotic/nonnative
Fragrant Bedstraw	*Galium*	*triflorum*	Rubiaceae	native
Hairy Bedstraw	*Galium*	*pilosum*	Rubiaceae	native
Long-stalked Cranesbill	*Geranium*	*columbinum*	Geraniaceae	exotic/nonnative
Small-flowered Cranesbill	*Geranium*	*pusillum*	Geraniaceae	exotic/nonnative
White Avens	*Geum*	*canadense*	Rosaceae	native
Rough Avens	*Geum*	*virginianum*	Rosaceae	native
Gill-over-the-ground	*Glechoma*	*hederacea*	Labiatae	exotic/nonnative
Cudweed	*Gnaphalium*	*obtusifolium*	Asteraceae	native
Virginia Stickseed	*Hackelia*	*virginiana*	Boraginaceae	native
Sneezeweed	*Helenium*	*autumnale*	Asteraceae	native
Thin-leaved Sunflower	*Helianthus*	*decapetalus*	Asteraceae	native
Rough Ox-eye	*Heliopsis*	*scabra*	Asteraceae	native
Ox Eye Daisy	*Heliopsis*	*helianthoides*	Asteraceae	native
Day Lily	*Hemerocallis*	*fulva*	Liliaceae	exotic/nonnative
Round-lobed Hepatica	*Hepatica*	*americana*	Ranunculaceae	native

Common Name	Genus	Species	Family	Native
Dame's Rocket	*Hesperis*	*matronalis*	Cruciferae	exotic/nonnative
Flower-of-an-Hour	*Hibiscus*	*trionum*	Malvaceae	exotic/nonnative
Virginia Waterleaf	*Hydrophyllum*	*virginianum*	Hydrophyllaceae	native
Common St. Johnswort	*Hypericum*	*perforatum*	Guttiferae	exotic/nonnative
Spotted St. Johnswort	*Hypericum*	*punctatum*	Guttiferae	native
Dwarf St. Johnswort	*Hypericum*	*mutilum*	Guttiferae	native
Jewelweed	*Impatiens*	*capensis*	Balsaminaceae	native
Pale Touch-Me-Not	*Impatiens*	*pallida*	Balsaminaceae	native
Ivy-Leaved Morning-Glory	*Ipomea*	*hederacea*	Convulvulaceae	exotic/nonnative
Twinleaf	*Jeffersonia*	*diphylla*	Berberidaceae	native
Water Willow	*Justicia*	*americana*	Acanthaceae	native
Prickly Lettuce	*Lactuca*	*scariola*	Asteraceae	exotic/nonnative
Wood Nettle	*Laportea*	*canadensis*	Urticaceae	native
Motherwort	*Leonurus*	*cardiaca*	Labiatae	exotic/nonnative
Field Cress	*Lepidium*	*campestre*	Cruciferae	exotic/nonnative
Bushclover	*Lespedeza*	*intermedia*	Leguminosae	native
Butter-and-eggs	*Linaria*	*vulgaris*	Scrophulariaceae	exotic/nonnative
False Pimpernel	*Lindernia*	*dubia*	Scrophulariacea	native
Cardinal Flower	*Lobelia*	*cardinalis*	Lobeliaceae	native
Great Lobelia	*Lobelia*	*syphilitica*	Lobeliaceae	native
Indian Tobacco	*Lobelia*	*inflata*	Lobeliaceae	native
Spiked Lobelia	*Lobelia*	*spicata*	Lobeliaceae	native
White Campion	*Lychnis*	*alba*	Caryophyllaceae	exotic/nonnative
Northern Bugleweed	*Lycopus*	*uniflora*	Labiatae	native
Moneywort	*Lysimachia*	*nummularia*	Primulaceae	exotic/nonnative
Fringed Loosestrife	*Lysimachia*	*ciliata*	Primulaceae	native
White Sweetclover	*Melilotus*	*alba*	Leguminosae	exotic/nonnative
Yellow Sweetclover	*Melilotus*	*officinalis*	Leguminosae	exotic/nonnative
Virginia Bluebell	*Mertensia*	*virginica*	Boraginaceae	native
Bishop's Cap	*Mitella*	*diphylla*	Saxifragaceae	native
Wild Bergomot	*Monarda*	*fistulosa*	Labiatae	native
Indian Pipe	*Monotropa*	*uniflora*	Pyrolaceae	native
Watercress	*Nasturtium*	*officianale*	Cruciferae	exotic/nonnative
Catnip	*Nepeta*	*cataria*	Labiatae	exotic/nonnative
Common Evening Primrose	*Oenothera*	*biennis*	Onagraceae	native
Northern Evening Primrose	*Oenothera*	*parviflora*	Onagraceae	native
White Evening Primrose	*Oenothera*	*speciosa*	Onagraceae	native
Star-of-Bethlehem	*Ornithogalum*	*umbellatum*	Liliaeae	exotic/nonnative
Sweet Cicely	*Osmorhiza*	*claytoni*	Umbelliferae	native
Yellow Wood Sorrel	*Oxalis*	*europaea*	Oxalidaceae	native
Yellow Wood-Sorrel	*Oxalis*	*stricta*	Oxalidaceae	native
Poppy	*Papaver*	*dubium*	Papaveraceae	exotic/nonnative
Ditch Stonecrop	*Penthorum*	*sedoides*	Saxifragaceae	native
Beefsteak Plant	*Perilla*	*frutescens*	Labiatae	exotic/nonnative
Mountain Phlox	*Phlox*	*ovata*	Polemoniaceae	native
Blue Phlox	*Phlox*	*divaricata*	Polemoniaceae	native

Common Name	Genus	Species	Family	Native
Lopseed	*Phryma*	*leptostachya*	Phrymaceae	native
Smooth Ground Cherry	*Physalis*	*subglabrata*	Solanaceae	native
Common Ground-cherry	*Physalis*	*heterophylla*	Solanaceae	native
Pokeweed	*Phytolacca*	*americana*	Phytolaccaceae	native
Clearweed	*Pilea*	*pumila*	Urticaceae	native
Common Plantain	*Plantago*	*rugellii*	Plantaginaceae	native
Common Plantain	*Plantago*	*major*	Plantaginaceae	exotic/nonnative
English Plantain	*Plantago*	*lanceolata*	Plantaginaceae	exotic/nonnative
Mayapple	*Podophyllum*	*peltatum*	Berberidaceae	native
Solomon's Seal	*Polygonatum*	*canaliculatum*	Liliaceae	native
Mild Water Pepper	*Polygonum*	*hydropiperoides*	Polygonaceae	native
Water Smartweed	*Polygonum*	*coccineum*	Polygonaceae	native
Dock-leaved Smartweed	*Polygonum*	*lapathifolium*	Polygonaceae	native
Ladies Thumb	*Polygonum*	*persicaria*	Polygonaceae	exotic/nonnative
Water Smartweed	*Polygonum*	*punctatum*	Polygonaceae	native
Asiatic Water Pepper	*Polygonum*	*cespitosum*	Polygonaceae	exotic/nonnative
Large-flowered Leafcup	*Polymnia*	*uvedalia*	Asteraceae	native
Rough-fruited Cinquefoil	*Potentilla*	*recta*	Rosaceae	exotic/nonnative
Rough Cinquefoil	*Potentilla*	*norvegica*	Rosaceae	native
Tall Cinquefoil	*Potentilla*	*arguta*	Rosaceae	native
Self-Heal	*Prunella*	*vulgaris*	Labiatae	native
Swamp Buttercup	*Ranunculus*	*septentrionalis*	Ranunculaceae	native
Crowfoot	*Ranunculus*	*abortivus*	Ranunculaceae	native
Cursed Crowfoot	*Ranunculus*	*sceleratus*	Ranunculaceae	native
Hooked Crowfoot	*Ranunculus*	*recurvatus*	Ranunculaceae	native
Black-Eyed Susan	*Rudbeckia*	*hirta*	Asteraceae	native
Brown-eyed Susan	*Rudbeckia*	*fulgida*	Asteraceae	native
Ruellia	*Ruellia*	*strepens*	Acanthaceae	native
Curly Dock	*Rumex*	*crispus*	Polygonaceae	exotic/nonnative
Sheep Sorrel	*Rumex*	*acetosella*	Polygonaceae	exotic/nonnative
Bloodroot	*Sanginaria*	*canadensis*	Papaveraceae	native
Long-Fruited Snakeroot	*Sanicula*	*trifoliata*	Umbelliferae	native
Black Snake Root	*Sanicula*	*marylandica*	Umbelliferae	native
Bouncing Bet	*Saponaria*	*officinalis*	Caryophyllaceae	exotic/nonnative
Wild Basil	*Satureja*	*vulgaris*	Labiatae	exotic/nonnative
Lizard Tail	*Saururus*	*cernuus*	Saururaceae	native
Early Saxifrage	*Saxifraga*	*virginiensis*	Saxifragaceae	native
Mad-dog Skullcap	*Scutellaria*	*lateriflora*	Labiatae	native
Wild Stonecrop	*Sedum*	*ternatum*	Crassulaceae	native
Squaw-weed	*Senecio*	*obovatus*	Asteraceae	native
Golden Ragwort	*Senecio*	*aureus*	Asteraceae	native
Prickly Mallow	*Sida*	*spinosa*	Malvaceae	exotic/nonnative
Hedge Mustard	*Sisymbrium*	*officinale*	Crusiferae	exotic/nonnative
Tumble Mustard	*Sisymbrium*	*altissimum*	Cruciferae	exotic/nonnative
Blue-eyed Grass	*Sisyrinchium*	*angustifolium*	Iridaceae	native
False Solomon's Seal	*Smilacina*	*racemosa*	Liliaceae	native

Common Name	Genus	Species	Family	Native
Horse Nettle	*Solanum*	*carolinense*	Solanaceae	native
Black Nightshade	*Solanum*	*americanum*	Solanaceae	native
Wreath Goldenrod	*Solidago*	*caesia*	Asteraceae	native
Sweet Goldenrod	*Solidago*	*odora*	Asteraceae	native
Late Goldenrod	*Solidago*	*gigantea*	Asteraceae	native
Early Goldenrod	*Solidago*	*juncea*	Asteraceae	native
Rough-stemmed Goldenrod	*Solidago*	*rugosa*	Asteraceae	native
Spiny Sow Thistle	*Sonchus*	*asper*	Asteraceae	exotic/nonnative
Venus Looking Glass	*Specularia*	*perfoliata*	Campanulaceae	native
Rough Hedge-Nettle	*Stachys*	*tenuifolia*	Labiatae	native
Common Chickweed	*Stellaria*	*media*	Caryophyllaceae	exotic/nonnative
Star Chickweed	*Stellaria*	*pubera*	Caryophyllaceae	native
Common Dandelion	*Taraxacum*	*officinale*	Asteraceae	exotic/nonnative
American Germander	*Teucrium*	*canadense*	Labiatae	native
Tall Meadow Rue	*Thalictrum*	*polygamum*	Ranunculaceae	native
Foam Flower	*Tiarella*	*cordifolia*	Saxifragaceae	native
Virginia Knotweed	*Tovara*	*virginiana*	Polygonaceae	native
Yellow Goat's Beard	*Tragopogon*	*pratensis*	Asteraceae	exotic/nonnative
Yellow Goat's Beard	*Tragopogon*	*major*	Asteraceae	exotic/nonnative
Low Hop Clover	*Trifolium*	*campestre*	Leguminosae	exotic/nonnative
Rabbit's Foot Clover	*Trifolium*	*arvense*	Leguminosae	exotic/nonnative
Red Clover	*Trifolium*	*pratense*	Leguminosae	exotic/nonnative
White Clover	*Trifolium*	*repens*	Leguminosae	exotic/nonnative
Red Trillium	*Trillium*	*erectum*	Liliaeae	native
Toad Trillium	*Trillium*	*sessile*	Liliaeae	native
Coltsfoot	*Tussilago*	*farfara*	Asteraceae	exotic/nonnative
Cattail	*Typha*	*latifolia*	Typhaceae	native
Burning Nettle	*Urtica*	*dioica*	Urticaceae	exotic/nonnative
Moth Mullein	*Verbascum*	*blattaria*	Scrophulariaceae	exotic/nonnative
Common Mullein	*Verbascum*	*thapsus*	Scrophulariaceae	exotic/nonnative
Blue Vervain	*Verbena*	*hastata*	Verbenaceae	native
White Vervain	*Verbena*	*urticifolia*	Verbenaceae	native
New York Ironweed	*Vernonia*	*noveboracensis*	Asteraceae	native
Corn Speedwell	*Veronica*	*arvensis*	Scrophulariaceae	exotic/nonnative
European Brooklime	*Veronica*	*beccabunga*	Scrophulariaceae	exotic/nonnative
Pale Violet	*Viola*	*striata*	Violaceae	native
Round-leaved Violet	*Viola*	*rotundifolia*	Violaceae	native
Common Blue Violet	*Viola*	*papilionacea*	Violaceae	native
Cocklebur	*Xanthium*	*strumarium*	Asteraceae	native

Sedges and Rushes

Common Name	Genus	Species	Family	Native
Blunt Broom Sedge	*Carex*	*tribuloides*	Cyperaceae	native
Carex	*Carex*	*laxiculmis*	Cyperaceae	native
Carex	*Carex*	*stipata*	Cyperaceae	native

Common Name	Genus	Species	Family	Native
Carex	*Carex*	*intumescens*	Cyperaceae	native
Carex	*Carex*	*frankii*	Cyperaceae	native
Carex	*Carex*	*lurida*	Cyperaceae	native
Many-flowered Flatsedge	*Cyperus*	*lancastriensis*	Cyperaceae	native
Galingale	*Cyperus*	*strigosus*	Cyperaceae	native
Nut Sedge	*Cyperus*	*esculentus*	Cyperaceae	native
Common Rush	*Juncus*	*effusus*	Juncaceae	native
Path Rush	*Juncus*	*tenuis*	Juncaceae	native
Great Bulrush	*Scirpus*	*validus*	Cyperaceae	native
Scirpus	*Scirpus*	*lineatus*	Cyperaceae	native

Vines

Common Name	Genus	Species	Family	Native
Trumpet Creeper	*Campsis*	*radicans*	Bignoniaceae	native
Climbing Bittersweet	*Celastrus*	*scandens*	Celastraceae	native
Field Bindweed	*Convolvulus*	*arvensis*	Convulvulaceae	exotic/nonnative
Japanese Hop	*Humulus*	*japonicus*	Canabinaceae	exotic/nonnative
Common Morning Glory	*Ipomea*	*purpurea*	Convulvulaceae	exotic/nonnative
Wild Potato Vine	*Ipomea*	*pandurata*	Convulvulaceae	native
Japanese Honeysuckle	*Lonicera*	*japonica*	Caprifoliaceae	exotic/nonnative
Moonseed	*Menispermum*	*canadense*	Menispermaceae	native
Virginia Creeper	*Parthenocissus*	*quinquefolia*	Vitaceae	native
Yellow Passion Flower	*Passiflora*	*lutea*	Passifloraceae	native
Poison Ivy	*Toxicodendron*	*radicans*	Anacardiaceae	native
Wineberry	*Rubus*	*phoenicolasius*	Rosaceae	exotic/nonnative
Black Raspberry	*Rubus*	*occidentalis*	Rosaceae	native
Flowering Raspberry	*Rubus*	*odoratus*	Rosaceae	native
One-seeded Bur Cucumber	*Sicyos*	*angulatus*	Cucurbitaceae	native
Cat Briar	*Smilax*	*rotundifolia*	Liliaceae	native
Periwinkle	*Vinca*	*minor*	Apocynaceae	exotic/nonnative
Summer Grape	*Vitis*	*aestivalis*	Vitaceae	native
Muscadine	*Vitis*	*rotundifolia*	Vitaceae	native
Winter Grape	*Vitus*	*vulpina*	Vitaceae	native

Ferns and Fern Allies

Common Name	Genus	Species	Family	Native
Maidenhair Spleenwort	*Asplenium*	*trichomanes*	Polypodiaceae	native
Meadow Spikemoss	*Selagenella*	*apoda*	Sellagenellaceae	native
Field Horsetail	*Equisetum*	*arvense*	Equisetaceae	native
Rattlesnake Fern	*Botrychium*	*virginianum*	Ophioglossaceae	native
Purple Cliff-brake	*Pellaea*	*atropurpurea*	Polypodiaceae	native
Common Maidenhair	*Adiantum*	*pedatum*	Polypodiaceae	native
Liverwort	*Marchantia*	*polymorpha*	Marchantiaceae	native
Ebony Spleenwort	*Asplenium*	*platyneuron*	Polypodiaceae	native

Common Name	Genus	Species	Family	Native
Fragile Fern	*Cystopteris*	*fragilis*	Polypodiaceae	native
Sensitive Fern	*Onoclea*	*sensibilis*	Polypodiaceae	native
Southern Lady Fern	*Athyrium*	*asplenioides*	Polypodiaceae	native
Bulblet Bladder Fern	*Cystopteris*	*bulbifera*	Polypodiaceae	native
Christmas Fern	*Polystichum*	*acrostichoides*	Polypodiaceae	native
Spinulose Wood Fern	*Dryopteris*	*spinulosa*	Polypodiacea	native
Rockcap Fern	*Polypodium*	*virginianum*	Polypodiaceae	native
Walking Fern	*Camptosorus*	*rhyzophyllum*	Polypodiaceae	native

Note: Ornamental species planted during and after the construction phase of NCTC are not included in this list, with the exception of the native warm season grasses planted in 1999. Some of the plants in the vine category could also be considered shrubs and visa versa. The list is current as of March 2004. Nomenclature tends to follow Strausbaugh and Core (1977), though is gradually conforming to NRCS Plants Database (http://plants.usda.gov) as changes are discovered. Identification by Dan Everson and Alan Temple; database maintained by Dan Everson.

Fungi

Identified and collected by WV DNR, June 26-28, 2001

Voucher specimens curated at Davis and Elkins College Herbarium

Auricularia auricularia	Tree-Ear (Jelly Fungi)
Bovista sp	Puffball
Chalciporus rubinellus	Purple-red Bolete
Cheimonophyllum candidissimus	White Oysterette
Collybia luxurians	(a gilled mushroom)
Conocybe lactea	White Dunce Cap
Coprinus quadrifidus	
Crepidotus applanatus	Flat Crepidotus
Crepidotus crocophyllus	
Crucibulum laeve	Bird's Nest Fungi
Daldinia concentrica	Carbon Balls, Crampballs
Exidia thuretiana	(a Jelly Fungi)
Gyroporus castaneus	Chestnut Bolete
Lepiota cristata	Malodorous Lepiota
Megacollybia platyphylla	(a gilled mushroom)
Microstoma floccosum [floccosa?]	Shaggy Scarlet Cup
Phylloporus rhodoxanthus	Gilled Bolete
Pluteus admirabilis	Yellow Pluteus
Pluteus atricapillus (P. cervinus)	Fawn Mushroom, Deer Mushroom
Polyporus mori	
Polyporus varius	
Psathyrella candolleana	Common Psathyrella
Sarcoscypha occidentalis	Stalked Scarlet Cup
Schizophyllum commune	Common Split Gill
Scleroderma areolatum	Puffball
Scutellinia scutellata	(a Saucer fungi)
Ustulina deusta	Carbon Cushion
Xerula megalospora	(a gilled mushroom)
Xerula radicata var. *radicata*	(a gilled mushroom)
Xylaria polymorpha	Dead Man's Fingers

Species with the Potential to Occur in the Vicinity of NCTC

The following vertebrate species can potentially be found in the vicinity of NCTC and are of particular interest to the West Virginia DNR:

Fish

Satinfin Shiner	*Notropis analostanus*
Slimy Sculpin	*Cottus cognatus*

Amphibians and Reptiles

Jefferson Salamander	*Ambystoma jeffersonianum*
Upland Chorus Frog	*Pseudacris triseriata feriarum*
Cricket Frog	*Acris crepitans crepitans*
Northern Leopard Frog	*Rana pipiens*
Spotted Turtle	*Clemmys guttata*
Wood Turtle	*Clemmys insculpta*
Redbelly Turtle	*Pseudemys rubriventris rubriventris*
Broadhead Skink	*Eumeces laticeps*

Birds

(Note: only nesting activity at NCTC is of interest, since these species can be seen during migration or during long-distance foraging activities.)

American Bittern	Long-eared Owl
Least Bittern	Bewick's Wren
Black Vulture	Sedge Wren
Osprey	Olive-sided Flycatcher
Coopers Hawk	Loggerhead Shrike
Northern Harrier	Golden-winged Warbler
Bald Eagle	Dickcissel
Peregrine Falcon	Bachman's Sparrow
Upland Sandpiper	Henslow's Sparrow
Barn Owl	Lark Sparrow

Mammals

Eastern Mole	*Scalopus aquaticus*
Indiana bat	*Myotis sodalis*
Least Weasel	*Mustela nivalis*
Northern Long-eared Bat	*Myotis septentrionalis*
Meadow Jumping Mouse	*Zapus hudsonius*
Pygmy Shrew	*Sorex hovi*
Star-nosed Mole	*Codylura cristata*

Appendix C: Scoping Summary

Appendix C: Scoping Summary

This appendix contains the issues, comments, and questions received during scoping information meetings for the National Conservation Training Center Environmental Assessment and the U.S. Fish and Wildlife Services responses to comments.

Thursday, October 29, 2009, 9:30 am Meeting

- When will the first prescribed burn occur?
- When will the project be implemented?
- Communicate to the public when burns will occur
- Number of alternatives
- Who decides if an alternative is viable?
- Quantitative measures – need numbers to measure success – desired conditions
- Include migratory birds and bald eagles in the analysis; be cautious about activities around the bald eagle nest
- Trail closures during treatments
- Eliminate nonnative plant species
- Maintain introduced cool-season grasses; 25 acres – keeping nonnative species is a concern
- There is community interest in the racetrack
- Cemetery – linked to Springwood
- Include other cultural sites in the EA
- There was pesticide use prior to FWS use
- Some feel there should be no pesticide use
- Consider a new alternative with a combination of treatments

Thursday, October 29, 2009, 6:30 pm Meeting

- Use practice (EA process/planning/treatments) to expand curriculum at NCTC
- Place plans on the NCTC website (such as IPM, PUPs, Deer Management Plan, etc.)
- Neighbors have same issues with nonnative species/weeds and treatments
- Consider groundwater concerns
- Applicators should use face masks
- Provide more detail on burning implementation
- Johnson grass – problems with eradication
- Educate community/neighbors regarding invasives, specifically Johnson grass
- Is prescribed burning an available tool for the public?

Comment documents received during the scoping period, which ended November 13, 2009.

Scoping Comment Document No.	Commenter	Individual Comment	FWS Response/Action
1	Mark Madison, Historian, NCTC	1.1 A great plan for restoring our landscape	No action required.
2	Joette Borzik, NCTC, Branch Chief, Conservation Leadership and Employee Development	2.1 Thanks for considering prescribed fire in the mix.	No action required.
3	Joe Witt, NCTC, Course Leader	3.1 The objectives need to be measureable	The current and desired conditions and the effects analysis include quantitative measurement indicators.
		3.2 There are no cumulative effects/ideas suggested in the scoping document.	The EA discusses any past, present, and reasonably foreseeable future actions that, if combined with the actions proposed in the EA, may result in cumulative effects. The EA complies with Council on Environmental Quality regulations that require the analysis of direct, indirect, and cumulative effects.
		3.3 Is there a timeline for the EA process?	The EA includes timelines for implementing various actions (in months and years, not specific dates).
		3.4 What laws or regulations are we complying with?	The EA contains a section on laws, policies, and regulations.
4	Joe Witt, NCTC, Course Leader	4.1 Suggested reviewing the following website re cumulative effects: http://www.ntc.blm.gov/krc/uploads/194/Cumulative%20Effects1.html	Website noted.
5	Steve Chase, NCTC Staff, Special Assistant to the Director	5.1 Correct first sentence to read: "Construction of the NCTC commenced in 1994, and the first training courses began in the Fall of 1997."	This was corrected in the EA.
6	Rich Mason, FWS, Chesapeake Bay Program in Annapolis	6.1 Carry out the tertiary treatment wetland to polish effluent from the on-site sewage treatment . . .	For engineering reasons, there are currently no definite plans to develop a wetland area to intercept, process, and infiltrate effluent from the sewer treatment plant.

Scoping Comment Document No.	Commenter	Individual Comment	FWS Response/Action
			Since, if deemed practical, it would expand wetland area and likely provide associated environmental improvement, this should be kept open as a future option.
		6.2 Evaluate stormwater run-off and carry-out methods to better infiltrate H20: Raise inlet grates, channel run-off into forests, convert turf areas to bioretention, etc.	This topic is outside the scope of the EA.
		6.3 Evaluate lawn care and eliminate fertilizers if any are used. The lawn experts say it's not healthy.	Fertilizers are currently not used on turf at the NCTC. Other than the possibility of using fertilization for initial establishment of newly seeded areas, if needed, no fertilization of turf is planned.
		6.4 Convert turf to shrub thickets for songbirds where feasible.	The area of turf formerly maintained by frequent mowing, already not extensive, is being reduced. Anticipated uses include reforestation with trees and shrubs, wildflower meadows, and minimally managed lawn. It should be recognized, however, that areas dedicated to shrubs and wildflowers would pose difficulties in establishment and management due to invasive exotic plants and deer.
		6.5 Another option is to convert turf to wsg/wildflowers.	See comment 6.4 above.
		6.6 Evaluate landscape plants - go all native if not already.	Lawns and landscaping are not covered in this EA. Some of the original landscape plants are not native, although none of the nonnative plants are known to be invasive. The practice in recent years, which is expected to continue, is to plant only local species. Species not meeting that criterion will gradually be replaced.
7	Frank Muth, NCTC, Conservation Science and Policy Branch	7.1 Objective 1 should read, “Protect [and restore] ecological integrity . . . “	The word “restore” has been added to Objective 1.

Scoping Comment Document No.	Commenter	Individual Comment	FWS Response/Action
		7.2 Re: Objective 1 – the objective does nothing to address this overarching deer problem itself . . . Is the 2003 White-tail Deer Management EA (USFWS 2003) still valid?	Yes, actions approved in the deer management plan EA are still valid, and deer management actions under that plan continue to be implemented.
		7.3 Page 6 [scoping document], Grassland Treatment Objective "e" – "Maintain 25 acres of *introduced* cool season grasses to be hayed annually by a cooperative farmer" (emphasis mine). • Does this objective meet some legal mandate? Otherwise, it does not meet the need as stated on top of page 4 (Objective 2, under both "Need (Existing Conditions)" and "Grasslands"), which state the goal as to "restore native vegetation." Furthermore, this treatment objective contradicts and complicates meeting the stated goal. How do you propose restoring some grassland areas, while maintaining a seed bank of nonnative species? It appears a lot of time and money would be spent attempting to control nonnative species on the remaining grassland areas if this seed bank is intentionally maintained.	There is a formal agreement (expires 12/2010) with a cooperative farmer to carry out the haying operation. There is no other applicable mandate. Most warm-season grass (WSG) fields established in this region (or in proximity to) are replacing fields dominated by nonnative grasses of the species often cut for hay. Controlling these grasses is not a major problem compared to controlling nonnative invasive weeds – both grasses and forbs – such as Johnsongrass, thistles, and downy brome that usually occur on sites where cool-season grasses are eliminated in preparation for WSG establishment. .
		7.4 Can the cooperative farmer hay native fields?	It is possible to cut native grasses for hay. The front (southernmost) field, which is primarily native WSG, is currently cut for hay. Under the criteria currently used, which delay the first cutting for nesting wildlife reasons, the farmer considers this to be the poorest quality hay. The expansion of haying of the native WSG is possible but would need to be done in a way that does not negatively affect nesting wildlife. Native cool-season grasses are already a component of the

Scoping Comment Document No.	Commenter	Individual Comment	FWS Response/Action
			other fields cut for hay. It is not currently practical to create large areas of upland fields dominated by cool-season grasses suitable for cutting for hay.
		7.5 Page 6, "Proposed Activities" (all) – All treatment activities should take the Migratory Bird Treaty Act (MBTA) into account, and obtain the necessary permits from our Migratory Bird Office (i.e., if ground-nesting or forb-nesting birds will be disturbed, comply with MBTA). See also: http://www.fws.gov/migratorybirds/	The EA analyzes the effects of treatment actions on migratory birds.
		7.6 [Page 6] "Activity 1" – last sentence is nonsensical: "This treatment could be applied to much of the grassland (on a rotational basis) if needed, but most likely would not only involve less than 10% per year."	This sentence has been removed.
		7.7 Page 7, "Activity 5 – Chemically treating undesirable species." I do not take issue with the treatment method, but ask that all course leaders are notified of treatment areas in advance, so we can pass the information on to visitors (both students and their families) to avoid these areas. Also, please ensure trails etc., are clearly marked to convey treatment areas. Page 8, "Activity 2" – see page 7, "Activity 5," note regarding treating grasslands (i.e., inform course leaders in advance of spraying chemicals in the forest).	A resource protection measure (mitigation measure) is included in Table 4 of the EA to notify staff and guests when and where pesticides will be applied.

Scoping Comment Document No.	Commenter	Individual Comment	FWS Response/Action
		7.8 Page 8, "Activity 1" merely active vs. passive voice recommendation: "Re-establish desired species" rather than "Re-establishment of desired species.	The has been corrected.
		7.9 All planted trees with tree guards (to avoid deer herbivory) should be capped and/or screened to prevent bird entrapment. Capped tree guards should be inspected at least once per year in the late winter or early spring to ensure tree guards do not act as nesting attractants, and therefore cause entrapment.	This has been added as a resource protection measure in Table 4 of the EA.
		7.10 Page 10, "Other Pests" – may I suggest another objective: "d. To protect native species from nonnative and invasive species' detrimental effects."	This is an objective of all current and proposed actions.
		7.11 [Page 10] "Activity 1" – "Problems caused" [by]? "such pests may be. . . ."	This sentence has been corrected in the EA.
		7.12 [Page 10] Activity 2" – There are two "Activity 2" noted: "Mechanical" & "Chemical." Should "Chemical" be "Activity 3"?	This has been corrected in the EA.
		7.13 Page 11 – see page 8 "Activity 1" for active voice suggestion.	This has been corrected in the EA.
		7.14 This scoping document appears to strongly emphasize vegetation control and/or management. What are our deer herd goals; resident goose management goals; migratory bird (grassland and forest-dwelling) management goals; how are bird boxes managed and maintained (remember to consider the MBTA)?	This EA largely addresses issues relating to vegetation management because those are the changes being considered. The alternatives being proposed deal with issues such as prescribed burning and controlling invasive plants and other types of pests. Wildlife population goals and management, per se, are not within the scope of this EA, but effects on wildlife habitat that could result from vegetation management actions are analyzed.

Scoping Comment Document No.	Commenter	Individual Comment	FWS Response/Action
		7.15 Bald eagle – although this species is no longer protected under the Endangered Species Act, it is protected under the Bald and Golden Eagle Protection Act (see also: http://www.fws.gov/le/pdffiles/BEPA.pdf). • Vegetation management considerations in and around the nest tree; • Trail maintenance and use in and around the nest tree; • Camera use, maintenance, and management on the nest tree.	The EA includes resource protection measures to ensure the bald eagles (and their nest) are not adversely affected by management actions.
		7.16 Feral cats – this nonnative species, which is a large concern regarding migratory (especially ground nesting) birds, may be covered under "Other Pests" (page 10); if so, I would consider it adequate under "Activity 2 – Mechanical Control . . . they are definitely a problem which should be considered in light of the emphasis placed on removing nonnative/invasive species.	This topic of other pests is covered in the EA.
8	Glenn Gravatt, NCTC Staff	8.1 FYI, the approximate acreage for NCTC is now 532 (the 6 acres of life estate along with the 2 cemeteries were deeded back to Hendrix)	This has been corrected in the EA.
9	Richard Rogers, District Wildlife Biologist, WV Division of Natural Resources	9.1 The WVDNR has used prescribed burning for a number of years on the Shannondale Springs Wildlife Management Area in Jefferson County. We have considered it a successful tool for moderating the affects of undesirable plant species.	Comment noted.
10	Ryan Hagerty, NCTC Staff, Production	10.1 A few years ago I remember reading this passage below and being concerned with the height that the farmer was mowing the front	Cutting height is a concern, for habitat reasons as well as plant health. This will be addressed with the farmer under the current agreement, as well as more formally

Scoping Comment Document No.	Commenter	Individual Comment	FWS Response/Action
		field. I talked to him about it a couple years ago but it looked like the front field was cut fairly short during the last few times that he cut hay. "Big bluestem can withstand substantial grazing. However if it is continually grazed closer than 6 to 8 inches, it will be out competed by other grass species."	in future agreements. There are mechanical and economic limitations on how high hay can be cut.
11	Jim Siegel, DEO, NCTC	11.1 My general observation is that our haying and mowing approaches do not generally create habitat for many grassland birds, such as eastern meadowlarks, grasshopper sparrows and field sparrows. It creates fairly large expenses that are relatively uniform in vertical height structure, with not much variety in grass or forb species. I believe the uniformity of the structure may itself be a problem for grassland bird use as this growth form is not common in natural communities. Grazing (by wild and domestic animals) and fire (wild and prescribed) leave some areas either untouched or less impacted. These clumps create variety in the structure of the vegetation that can last for a number of years and this variety is attractive to many grassland bird species for perching sites and breeding cover. I would recommend increasing the use of cool fires over any grasslands not entirely dedicated to haying and not trying to create a totally uniform burned area thereby creating some vertical variety in the vegetation structure post-burn.	There are fence rows and rock outcrops in and around most of these fields containing trees, shrubs, and herbaceous plants of various types and sizes, and cutting for hay typically leaves some uncut swaths along these features.

Scoping Comment Document No.	Commenter	Individual Comment	FWS Response/Action
		11.2 I would only recommend continuing to hay the historic racetrack itself to conserve its cultural integrity.	The historic racetrack will continued to be hayed.
		11.3 Furthermore some open areas hayed today, such as the front hayfield south of the entrance gate, could be restored to a more attractive open savanna environment by use of small copses of native trees and bushes, breaking up the large former agricultural field expense. I would also recommend the planting of small copses of native trees and shrubs to break up most of the former agricultural field fence-line patterns that are still evident on much of the 250 acres of grassland. These woodland copses will grow in time as birds and mammals use them and naturally reseed the open areas. A few wildlife enclosures can serve as controls to study the impacts of deer browse and herbivory by rodents and rabbits on woodland restoration.	There may be limited additional planting of trees and shrubs. These fields are not very large, and as noted above, already include trees, shrubs, and herbaceous plants of various types and sizes.

Appendix D: Pesticide Use Proposal

U.S. Fish and Wildlife Service
Pesticide Use Proposal

Date: 05/27/2010

PUP Number: R9-10-97310-002

Treatment Site: NATIONAL CONSERVATION TRAINING CENTER-DIVISION OF FACILITY OPERATIONS

Product Trade Name: Escort XP, Outrider

Region: 9 **Org Code:** 97310 **Year:** 2010

State/County: WV/JEFFERSON

Duty Station: NATIONAL CONSERVATION TRAINING CENTER-DIVISION OF FACILITY OPERATIONS

Management Unit(s): WSG field on southeast portion of property

Map Attached: No

Status: Submitted to Field (Dis)Approver

Pesticide Use Pattern:

Need for Treatment: State/Federal Listed Noxious Species

Treatment Site: Terrestrial

Treatment Site Land Type: grassland

Is the crop being treated a genetically modified organism(GMO) (Y/N): N

Management Action/Economic Threshold:

Since these are State-listed noxious weeds we should try to eliminate them entirely, though this is nearly impossible.

How does this pest(s) interfere with achieving habitat and/or wildlife management objectives?:

Johnson-grass is infesting a native warm-season grass field planted a few years ago. It is out-competing the native plants.

U.S. Fish and Wildlife Service
Pesticide Use Proposal

Date: 05/27/2010

Target Pest(s): Bull thistle (Cirsium vulgare)
Canada thistle (Cirsium arvense)
Johnson grass (Sorghum halapense)
Plumeless thistle (Carduus acanthoides)

Pesticides:

Trade Name: Escort XP

Common Name: metsulfuron-methyl

U.S. EPA Registration Number: 352-439

Manufacturer: DuPont Crop Protection

Label URL: http://www.cdms.net/LDat/ld5QT019.pdf

MSDS URL: http://www.cdms.net/LDat/mp5QT018.pdf

Trade Name: Outrider

Common Name: sulfosulfuron

U.S. EPA Registration Number: 524-500

Manufacturer: Monsanto Co.

Label URL:

MSDS URL: http://www.cdms.net/LDat/mp2ST012.pdf

Pesticide Details:

Restricted Use Pesticide (Y/N): N

Is the treatment site type listed on the label (Y/N): Y

Is pest listed on label: Y

If the crop, type of vegetation, or site type is not listed, is there a current Section 18 exemption under which you are proposing to operate (Y/N): N

If the crop, type of vegetation, or site type is not listed, is there a current Section 24c exemption under which you are proposing to operate (Y/N): N

Supplemental Label for Proposed Use (Y/N): N

U.S. Fish and Wildlife Service
Pesticide Use Proposal

Date: 05/27/2010

Tank Mix (Y/N): Y

Adjuvants: None, CWC Surfactant 90

Other Ingredients: N/A

Number of Applications: 1

Application Period: June - July

Application(s):

Note: Proposed pesticide applications in this PUP may not reflect actual on-the-ground pesticide applications. Specifically, PUPs may include different application scenarios (e.g., spray equipment and rate combinations) to capture the breadth of application options that could be used to treat target species. Actual pesticide applications must be compliant with the pesticide label(s). The completed pesticide usage report will contain actual usage information associated with this PUP.

Trade Name	Rate & Unit	Method	Equipment
Escort XP	0.75 oz/acre	Broadcast	Boom
Outrider	1.25 oz/acre	Broadcast	Boom

Size of Treatment Area: 15.00 acres

REI (Restricted Entry Interval): Until Dry

Applicator Information: Contractor, FWS

Name of FWS Lead Certified Pesticide Applicator: Philip Pannill

Approved IPM Plan (Y/N): Y

IPM Plan Year: 2008

Non-Chemical Controls Considered (Y/N): Y

IPM Strategy:

Mowing was carried out in this area the last two years to try to prevent J-grass seed production, but this does not affect the rhizomes or the existing seed bank.

Burning of the WSG fields is planned, hopefully starting 2011, which if continued over time should favor the WSG and help reduce the J-grass population.

U.S. Fish and Wildlife Service
Pesticide Use Proposal

Date: 05/27/2010

Best Management Practices:

Application at wind speeds less than 10 mph (but not inversion conditions) - must follow label.

Calibrate application equipment.

Field scouting/monitoring before pesticide application.

Pesticide application buffers around sensitive areas.

Use lowest effective application rate.

Vegetative buffers .

Additional Best Management Practices:

Use of nozzles that reduce spray particle size and potential for drift.

Treatment Site Conditions:

Topography (Degree Slope): Between 3.0 and 10.0 Degrees

Soil Texture: Silty Clay Loam

Soil pH: 6.5

Soil Organic Matter: unknown

Surface Water Type(s): Pond

Distance to nearest: 400+ ft

Depth to Groundwater: 20+ to 50 ft

Distance to nearest potable water: Less than 1/4 Mile

If Spot Treatment, Estimated % Cover to be Treated:

Is the Treated Area Naturally Flooded or Irrigated (Y/N): N

Irrigation Method: N/A

Non-Target Species At/Near Treatment Area during or immediately after treatment (taxonomic groups):

Mammals, Native Lepidopterans, Native Pollinating Insects, Reptiles, Sensitive Plants

Are Impacts to Non-Target Species Expected? (Y/N): Y

U.S. Fish and Wildlife Service
Pesticide Use Proposal

Date: 05/27/2010

Federally Listed Species and Critical Habitat(s):

Key:

NE = No Effect

NLAA = Not Likely to Adversely Affect

LAA = Likely to Adversely Affect

JAM = Jeopardy/Adverse Modification

NJNAM = No Jeopardy/No Adverse Modification

Note: ESA Documentation is required for NE, NLAA, LAA, JAM and NJNAM Effects Determinations. Please ensure you are in compliance with the current Endangered Species consultation procedures.

N/A

Are there any other federally listed, proposed or candidate species or critical habitat(s) that occur (or may occur) at or near the site that are not listed above? (Y/N): N

Are there any state listed, proposed or candidate species or their habitats or other species of concern that may be affected by the proposed activity? (Y/N): N

Contact Person: Philip Pannill
Phone: 304-876-7432
Fax: 304-876-7223

Project Leader: Karin Christensen
Phone: 304-876-7222

Alternate Contact:

Submitter Comments:

The treatment area is a warm-season grass field that is infested with Johnson-grass and various thitles. Outrider is to be applied to control the J-grass and Escort XP to control the thistles.

This is to be used in just a portion of the infested grassland area as a "trial run."

Reviewer Information:

Requested Approval Period: 1 year **Approval Expires:** 12/31/2010

Appendix E: Pesticide Information

Appendix E: Pesticide Information

All pesticides sold in the United States must be accepted for registration by the U.S. Environmental Protection Agency (EPA) based on a minimum of 120 scientific studies showing that the pesticide will perform its intended function without unreasonable adverse effects on humans, animals, or the environment. The EPA defines unreasonable adverse effects as any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of the pesticide.

All pesticides considered for use at the NCTC must be studied, approved, and registered by the EPA and by the West Virginia Department of Agriculture. The use of pesticides (herbicides, insecticides, fungicides, rodenticides and similar materials) on FWS property, including the NCTC, is conducted according to the resource protection measures listed in Table 4., and in compliance with an approved Pesticide Use Proposal (example in Appendix D) and with all federal and state regulations.

The selection of a product is based on factors such as the health and safety of the applicator and the public, effectiveness on the particular target organism, potential effects on nontarget organisms and the environment, the type of area to be treated, and the most suitable method of application. In this appendix, information is provided on a number of different products. Typically, not all of these would be used in any given year, if ever. While some are likely to be used on a regular basis, most would be used only to address situations that may rarely develop. Information is provided to cover the majority of products that could be used over the course of time to address potential needs. Having a variety of such products available to use, as appropriate, in combination with other types of control methods as provided for under an integrated pest management (IPM) plan, enables managers to utilize the best course of action. Because different companies market products with the same active ingredients under different names, pesticide names and products change over time and new pest problems appear, the specific products listed may be superseded by similar products with the same or improved safety and efficacy characteristics.

Commonly, only “General Use” pesticides would be used, as opposed to “Restricted Use” pesticides that typically have a greater potential for human or environmental effects. Generally, only products that bear the signal word of “Caution” are used, as opposed to the “Warning” and “Danger” signal words higher on the continuum of toxicity or potential risk.

All pesticides must be applied by a License Pesticide Applicator or by trained personnel under his or her supervision.

Herbicides

The herbicides currently used at the NCTC (in some cases a nearly identical product with the same active ingredient) are, in approximate order of area treated:

- Accord Concentrate
- Milestone VM
- Escort XP
- Garlon 3A
- Garlon 4 Ultra

- Outrider
- Sethoxydim E Pro
- Plateau

The discussions below provide EPA and manufacturer websites for pesticide fact sheets for the above-listed herbicides and also presents summaries of the fact sheets.

Accord Concentrate

The active ingredient is glyphosate (EPA Registration #62719-324). It is among the most widely used pesticides by volume. It is a nonselective herbicide registered for use on many food and nonfood field crops, as well as noncrop areas and wetlands where total vegetation control is desired. It is used to control grasses, broadleaf weeds, and woody plants in many food and nonfood crops and a variety of other sites, including ornamentals, lawns, and turf, residential areas, and forest plantings.

At the NCTC glyphosate is used for control of exotic plants such as Johnsongrass and Japanese stiltgrass, as well as other plant species in landscape and reforestation sites.

EPA has determined (based on current data) that the effects of glyphosate are minimal on birds, mammals, fish, and invertebrates. The nature of glyphosate residue in plants and animals is adequately understood. Most of the glyphosate (from ingestion) in animals is eliminated in urine and feces. Metabolism studies in rats show that most (97.5 percent) of the glyphosate directly administered was excreted in urine and feces and less than 1 percent of the absorbed dose remained in tissues and organs. A second study using rats showed that very little glyphosate reaches bone marrow, that it is rapidly eliminated from bone marrow, and that it is even more rapidly eliminated from plasma. Studies with a variety of plants indicate that uptake of glyphosate from soil is limited, and any material that is taken readily moves throughout the plant and into its fruit.

View product fact sheets at

http://www.epa.gov/oppsrrd1/REDs/factsheets/0178fact.pdf

http://www.epa.gov/safewater/contaminants/basicinformation/glyphosate.html#three

http://www.epa.gov/safewater/hfacts.html

http://www.cdms.net/manuf/1prod.asp?pd=5095&lc=0

http://www.cdms.net/manuf/mprod.asp?mp=11&lc=0&ms=3691&manuf=11

Milestone VM

The active ingredient is aminopyralid (EPA Registration #62719-537). It is a selective herbicide for the control of certain broadleaf weeds and woody plants. Aminopyralid is a new pyridine carboxylic acid herbicide intended for use in rangeland, permanent grass pastures, non-cropland areas (rights-of-way, roadsides, and non-irrigation ditch banks), natural areas (wildlife management areas, natural recreation areas, campgrounds, trailheads, and trails), and grazed areas in and around these sites, as well as wheat. Aminopyralid provides systemic post-emergence broad-spectrum control of a number of key noxious and invasive annual, biennial, and perennial weed species, as well as agronomic broadleaf weeds. Aminopyralid can also provide residual weed control activity controlling re-infestations and reducing the need for re-treatment, depending on the rate applied and the target weeds.

At the NCTC aminopyralid is used for selective control of thistles and certain other invasive broadleaf weeds and woody plants in grasslands and forests.

Aminopyralid has been shown to be practically nontoxic to birds, fish, honeybees, earthworms, and aquatic invertebrates. It is slightly toxic to eastern oyster, algae, and aquatic vascular plants. Acute toxicity data indicate that aminopyralid has low toxicity via oral, dermal, and inhalation routes of exposure, and it has been classified as "not likely" to be carcinogenic to humans. No increases in any tumors were found in carcinogenicity studies in rats and mice. In a metabolism study in rats, aminopyralid was rapidly absorbed, distributed, and excreted following oral administration.

View detailed information at

http://www.epa.gov/opprd001/factsheets/aminopyralid.pdf

http://www.cdms.net/manuf/1prod.asp?pd=8113&lc=0

http://www.cdms.net/manuf/mprod.asp?mp=11&lc=0&ms=3691&manuf=11

Escort XP

The active ingredient is metsulfuron-methyl (EPA Registration #352-439). It is a selective herbicide for control of certain broadleaf weeds and woody plants.

At NCTC metsulfuron-methyl is used for control of multiflora rose, thistles, tree of heaven and certain other invasive broadleaf weeds and woody plants.

The acute toxicity data indicate that metsulfuron-methyl has low acute oral, dermal, and inhalation toxicity. It has as low toxicity to mammals, birds, and insects and does not bioaccumulate in warm- or cold-blooded animals. It is rapidly absorbed and eliminated. It degrades at a moderate rate in soil and exhibits weak binding to soils. Like other sulfonylurea herbicides, it will predominate in the water phase and not in sediments. It has the potential to leach to groundwater or reach surface water by runoff. Metsulfuron has low potential to volatilize from soil or water or to bioaccumulate in fish.

View detailed information at

http://extoxnet.orst.edu/pips/metsulfu.htm

http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC32809

http://www.cdms.net/LDat/ld5QT017.pdf

http://www.umt.edu/sentinel/escort_label.pdf

http://www2.dupont.com/Land_Management/en_US/assets/downloads/pdfs/General/K-14796.pdf

http://msds.dupont.com/msds/pdfs/EN/PEN_09004a35804efd0b.pdf

Garlon 3A

The active ingredient is triclopyr (triclopyr triethylamine or triclopyr TEA) (EPA Registration #62719-37). It is a selective herbicide used to control broadleaf weeds and brush on a variety of sites, such as rights-of-way, pastures, forests, wetlands, and turf, including home lawns.

At NCTC triclopyr is used for selective control of autumn olive, winged euonymus and a variety of other invasive broadleaf weeds and woody plants.

Triclopyr was found to be practically nontoxic to slightly toxic to birds and estuarine/marine invertebrates and practically nontoxic to mammals, insects, freshwater fish, freshwater invertebrates, and estuarine/marine fish. However, it can cause eye irritation to persons involved in mixing and application, so it merits extra precautions. It is approved for use in wetland and riparian sites.

View detailed information at

http://www.epa.gov/oppsrrd1/REDs/factsheets/2710fact.pdf

http://www.cdms.net/manuf/1prod.asp?pd=1923&lc=0

http://www.cdms.net/manuf/mprod.asp?mp=11&lc=0&ms=3691&manuf=11

Garlon 4 Ultra

The active ingredient is triclopyr ester (triclopyr butoxyethyl ester or triclopyr BEE) (EPA Registration #62719-527). It is also a selective herbicide to control broadleaf weeds and brush on a variety of sites.

At NCTC triclopyr ester is used solely in basal bark application, in which the product is diluted with vegetable or mineral oil and applied onto the bark of the trunk of an individual unwanted tree or shrub—usually tree of heaven or larger multiflora rose, autumn olive, and bush honeysuckle shrubs.

Testing of triclopyr ester indicated it to be slightly toxic to birds, moderately toxic to highly toxic to freshwater fish and estuarine/marine invertebrates, slightly to moderately toxic to freshwater invertebrates, and highly toxic to estuarine/marine fish.

View detailed information at

http://www.epa.gov/oppsrrd1/REDs/factsheets/2710fact.pdf

http://www.cdms.net/manuf/1prod.asp?pd=8141&lc=0

http://www.cdms.net/manuf/mprod.asp?mp=11&lc=0&ms=3691&manuf=11

Outrider

The active ingredient is sulfosulfuron (EPA Registration #524-500). It is a selective, systemic herbicide formulated as a water dispersible granule for control of many annual and perennial grass and broadleaf weeds in noncrop areas. It is very effective in the control of Johnsongrass (*Sorghum halepense L.*), and it also controls tall fescue (*Schedonorus phoenix Scop*.) at higher rates. Outrider is used to control Johnsongrass on roadsides and is also labeled for use on some warm season grasses. It is absorbed through the roots and foliage of plants, rapidly inhibiting the growth of vegetation. It may be used over the top of many perennial grasses and can be used for weed control in hayfields and pastures and in selected rangeland grasses.

At NCTC sulfosulfuron is used to control Johnsongrass in warm-season grass fields.

Toxicity tests on mice and rabbits show that sulfosulfuron is slightly or practically nontoxic and does not cause mortality. Tests also show it is practically nontoxic to birds and invertebrates, and no more than slightly toxic to freshwater fish. It is highly toxic to nontarget plants. The use of sulfosulfuron in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination.

View detailed information at
http://www.rrsi.com/index.php?act=products.view&pid=467

http://www.cdms.net/LabelsMsds/LMDefault.aspx?pd=3864&t=1,2,3,4

Sethoxydim E Pro

The active ingredient is sethoxydim (EPA Registration #79676-4). Sethoxydim is used post-emergence for selective control of annual and perennial grass weeds in broadleaf crops. Sethoxydim is registered for residential (consumer) use on ornamentals and flowering plants, lawns, recreational areas, and around buildings/structures (outdoor). Sethoxydim is currently registered for use in or on at least 86 different agricultural crops such as various grains, fruits, tree nuts, vegetables and herbs, as well as non-agricultural sites, including ornamentals and flowering plants, recreational areas, right-of-way, along fences, hedgerows, and public and commercial buildings/structures.

At NCTC sethoxydim is used for selective control of Japanese stiltgrass.

The acute toxicity data indicate that sethoxydim is moderately toxic via oral, dermal, and inhalation routes of exposure. It is neither irritating to the eye nor the skin. Technical sethoxydim is practically nontoxic to mammals on an acute basis and no risks are expected for maximum label rates. It is practically nontoxic to birds on an acute basis. The screening level ecological risk assessment for endangered species resulted in a determination that sethoxydim results in no direct effects, either chronic or acute, on mammals, aquatic phase amphibians, mollusks, and marine/estuarine fish and crustaceans. There also are no direct acute effects on avian species, freshwater fish and crustaceans, and no direct effects on terrestrial and semi-aquatic dicots. A bee toxicity study indicted that sethoxydim technical is practically nontoxic to bees on an acute contact basis, which implies there is likely not a direct acute effect on insects. Sethoxydim is unlikely to contaminate ground or surface waters because it is not persistent under most conditions.

View detailed information at
http://www.regulations.gov/search/Regs/home.html#documentDetail?D=EPA-HQ-OPP-2007-0674-0021

http://www.cdms.net/LDat/ld8BC001.pdf

http://www.cdms.net/LDat/mp8BC002.pdf

Plateau

The active ingredient is imazapic (ammonium salt of imazapic; imazapyr salt) (EPA Registration #241-365). It is a selective herbicide for the control of certain grasses and broadleaf weeds. It is used for pre- and post-emergence control of a broad range weeds, including terrestrial annual and perennial grasses and broad-leaved herbs, woody species, and riparian and emergent aquatic species. Imazapic is also used for weed control in the establishment of native prairie grasses and certain other grasses.

Although not recently used at NCTC imazapic has been used for control of Johnsongrass and other invasive grass weeds in warm-season prairie grass fields.

The EPA has determined that there are no risks of concern to terrestrial birds, mammals, and bees, or to aquatic invertebrates and fish. For terrestrial organisms, available acute and chronic

toxicity data indicate that imazapyr acid and salt are practically nontoxic to birds, mammals, and honeybees. However, there are ecological risks of concern associated with the use of imazapyr for nontarget terrestrial plants and aquatic vascular plants, and potential risks to federally listed threatened and endangered plant species, which include aquatic vascular plants and terrestrial and semi-aquatic monocots and dicots, that cannot be precluded at this time.

View detailed information at

http://www.epa.gov/pesticides/reregistration/REDs/imazapyr_red.pdf

http://www.cdms.net/LabelsMsds/LMDefault.aspx?pd=3778&t=1,2,3,4

Other Pesticides to Control Pests

The following are proposed for use under Alternative C to control other pests.

Herbicides

Pendulum AquaCap

The active ingredient is pendimethalin (EPA Registration #241-416). Pendimethalin is a selective herbicide used to control broadleaf weeds and grassy weed species in a number of crop and non-crop areas and on residential lawns and ornamentals. Pendimethalin primarily affects only newly germinated herbaceous plants.

Pendimethalin would be used At NCTC for protection of tree seedlings in forest restoration areas from weed competition and for weed prevention in landscape areas.

Pendimethalin does not represent a high acute risk to birds or a high acute or chronic risk to mammals. It is, however, toxic to fish and should not be applied directly to water or to areas where surface water is present. Drift and runoff from treated areas may be hazardous to aquatic organisms. The use of pendimethalin may adversely affect endangered species of terrestrial and semi-aquatic plants, aquatic plants, and invertebrates, including mollusks, fish, and birds (specifically grazers).

In studies using laboratory animals, pendimethalin generally has been shown to be of low acute toxicity. It is slightly toxic by the oral and eye route and has been placed in Toxicity Category III (the second lowest of four categories) for these effects. It is practically nontoxic by the dermal and inhalation routes.

Pendimethalin dissipates in the environment by binding to soil, thus it is essentially immobile in soil. Because of its high affinity to bind to soil and sediment particles, concentrations of pendimethalin in surface waters is expected to be limited.

View detailed information at

http://www.epa.gov/oppsrrd1/REDs/factsheets/0187fact.pdf

http://www.epa.gov/oppsrrd1/REDs/0187red.pdf

http://www.cdms.net/manuf/1prod.asp?ms=6520&pd=6280&manuf=82&lc=0

http://betterplants.basf.us/products/pendulum-aquacap-herbicide.html

SureGuard

The active ingredient is flumioxazin (EPA Registration #59639-120). It is a pre-emergence and early post-emergence herbicide for control of selected grass and broadleaf weeds in and around ornamental woody shrubs, deciduous trees and conifers grown outdoors in containers or in the field (in ground) and to maintain bare ground noncrop areas.

Flumioxazin would be used at the NCTC to for weed prevention in ornamental and landscape areas.

The data available at this time indicate that flumioxazin is highly toxic to target and nontarget plants. It is also toxic to aquatic invertebrates and should not be applied to water or in areas where surface water runoff is possible. It is unlikely that flumioxazin will pose a risk of acute or chronic toxicity to nontarget animals. It is classified as a "not likely" human carcinogen. Applicators must use appropriate protective gear because use of flumioxazin may result in short- and intermediate-term dermal and inhalation exposure during mixing, loading, applying, and post-application activities. Flumioxazin is classified as a "not likely" human carcinogen. Flumioxazin is relatively unstable and its potential to leach to groundwater is low. The potential for the degradation products to leach to groundwater is high.

View detailed information at

http://www.epa.gov/opprd001/factsheets/flumioxazin.pdf

http://www.valent.com/professional/products/sureguard/label-msds.cfm

Insecticides

Horticultural Oils

Horticultural oils (EPA Registration #10404-66) are light-weight petroleum or vegetable-based oil. They are used in both horticulture and agriculture, where they are applied as a dilute spray on plant surfaces to control insects and mites. The oils provide control by smothering the target pests and are only effective if applied directly to the pest; they provide no residual controls. Oils are generally considered suitable for "'organic pest control," with most oils permitted under the U.S. National Organic Program.

Horticultural oils would be used at the NCTC to control a wide range of insects and mites such as scale insects, hemlock wooly adelgid, aphids, sawfly, leafminer and spider mites in landscape and reforestation sites.

Toxicity is minimal, and oils quickly dissipate through evaporation, leaving little residue. Oils pose few risks to people.

Insecticidal Soap

Insecticidal soap is defined as any of the potassium fatty acid soaps (EPA Registration #42697-1) used to control many plant pests. It is typically sprayed on plants in the same manner as other insecticides. Insecticidal soap works only on direct contact with the insects. The fatty acids disrupt the structure and permeability of the insect cell membranes. Insecticidal soaps are used against soft bodied insects and mites such as aphids, thrips, white flies, spider mites, and immature leafhoppers.

Insecticidal soap would be used at the NCTC to control a wide variety of insects and mites such scale insects, sawfly larvae, aphids and spider mites in landscape and reforestation sites.

The soaps have low toxicity to mammals.

Neem Oil

Neem oil (EPA Registration #70051-9-54705) is a vegetable oil pressed from the fruits and seeds of neem (*Azadirachta indica*), an evergreen tree which is endemic to the Indian subcontinent and has been introduced to many other areas in the tropics. It is perhaps the most important of the commercially available products of neem for organic farming and medicines. It is a broad-spectrum insecticide/fungicide/miticide

Neem oil would be used at the NCTC to control scale insects, spider mites, leaf-roller and other insects in landscape and reforestation sites.

Neem oil is not toxic to mammals or birds, but it is toxic to fish and invertebrates. It may cause mild reversible skin or eye irrigation in humans if not handled properly.

View detailed information at

http://www.planetnatural.com/planetnatural/images/neem-oil-msds.pdf

http://www.planetnatural.com/planetnatural/images/neem-oil-label.pdf

Dipel (BT)

The active ingredient is *bacillus thuringiensis* (EPA Registration #73049-39). *Bacillus thuringiensis* is designed for control of the larvae of lepidopterous insects. The sites where it is used is in nurseries, ornamentals, and shade and forest trees.

Bacillus thuringiensis would be used at the NCTC for control of gypsy moth, bagworms, webworms, and other caterpillar pests in landscape and reforestation sites, and if necessary, control of gypsy moth in woodlands.

The EPA does not anticipate any toxicological or pathogenic problems with *Bacillus thuringiensis*.

View detailed information at

http://www.epa.gov/pesticides/biopesticides/ingredients/tech_docs/brad_006514-006515.pdf

http://www.epa.gov/oppbppd1/biopesticides/ingredients/factsheets/factsheet_006476.htm

http://www.epa.gov/pesticides/biopesticides/pips/reg-biotech.pdf

http://www.valent.com/agriculture/products/dipel/loader.cfm?csModule=security/getfile&pageid=19241

http://lbamspray.com/Reports/BacillusthuringiensisSafetyReview031208.pdf

Pyrethrin

The active ingredient is pyrethrin (EPA Registration #1021-1785). Pyrethrins are botanical insecticides derived from chrysanthemum flowers most commonly found in Australia and Africa. They work by altering nerve function, which causes paralysis in target insect pests and eventually resulting in death.

Pyrethrin would be used in indoor and outdoor areas at the NCTC to control beetles, aphids, bagworms, mosquitoes, ticks, Brown marmorated stink bugs, shoot moths, webworms, and cockroaches.

The active ingredient pyrethrin might also be used in the aerosol product Wasp-Freeze (EPA Registration #499-362) for spot treatment of wasp, hornet, and yellow-jacket nests in areas where guests or staff might be present.

The EPA did not find acute or chronic risk for listed or nonlisted mammals and birds.

There are risk concerns for honeybees, which suggest there may also be concerns for nontarget insects.

Pyrethrins are highly toxic to fish and other aquatic organisms. Because the pyrethrins can

accumulate in sediments, risk to sediment-dwelling organisms is an area of particular concern.

EPA data indicate that pyrethrins have low acute toxicity via oral, dermal, and inhalation routes of exposure and are not skin sensitizers.

View detailed information at

http://www.epa.gov/pesticides/reregistration/REDs/pyrethrins_red.pdf

http://www.epa.gov/oppsrrd1/reevaluation/pyrethroids-pyrethrins.html

http://www.epa.gov/oppsrrd1/reevaluation/paw-factsheet.html

http://www.bonideproducts.com/lbonide/backlabels/l857.pdf

http://pestcontrol.basf.us/products/wasp-freeze-wasp-and-hornet-killer.html

Conserve

The active ingredient is spinosad (EPA Registration #62719-921). Spinosad is derived through the fermentation of a naturally occurring organism. Spinosad works by contact and by ingestion. Contact occurs either by direct application to the insect or by movement of the insect onto a treated surface. Ingestion occurs as insects feed on treated substrate (such as foliage). While control via contact is highly effective, control via ingestion is 5–10 times more effective.

Spinosad would be used at the NCTC to control lepidopterous and sawfly larvae, and other insects in landscape, reforestation and forest areas.

There are no acute or chronic levels of concern exceeded for birds, terrestrial and freshwater aquatic organisms, or acute levels of concern for estuarine organisms.

Spinosad was accepted for review and registration by the U.S. Environmental Protection Agency (EPA) through its Reduced Risk Pesticide Initiative, a program, which began in 1993, that expedites the review and registration decision-making process of new pesticides that have been shown to pose less risk to human health and the environment than existing conventional alternatives. Conserve® SC turf and ornamental insect control carries no precautionary signal

word based on its favorable toxicological and environmental profile, and the Worker Protection Standard re-entry interval is only four hours.

Spinosad is relatively short lived in the field and photo degrades rapidly, with half-lives less that one day. Leaching data show that spinosad and its aged residues are unlikely to leach in most soils, are relatively immobile, and possess little threat to groundwater.

View detailed information at

http://www.epa.gov/opprd001/factsheets/spinosad.pdf

http://www.dowagro.com/turf/prod/spinosad.htm

http://www.dowagro.com/turf/prod/conserve.htm

Merit 2F

The active ingredient is imidacloprid (EPA Registration #432-1312). Imidacloprid is used to control sucking insects, some chewing insects including, termites, soil insects, and fleas on pets. In addition to its topical use on pets, imidacloprid may be applied to structures, crops, soil, and as a seed treatment.

Imidacloprid would be used at the NCTC to control emerald ash borer, hemlock wooly adelgid, Ips beetles, and other insects and mites. Imidacloprid is toxic to upland game birds and highly toxic to bees, especially if used as a foliar application.

Imidacloprid is highly toxic to aquatic organisms. Studies in rats and rabbits show no skin irritation and minimal irritation to eyes.

View detailed information at

http://npic.orst.edu/factsheets/imidacloprid.pdf

http://greenhouse.ucdavis.edu/pest/labels/Merit%202F.pdf

http://www.backedbybayer.com/BAYER/CropScience/BackedByBayer.nsf/7941184401456BC5852572F8005B6570/$FILE/Merit%202F%20432-1312%20060922A%20SRL.pdf

http://www.backedbybayer.com/BAYER/CropScience/BackedByBayer.nsf/47D4F6E92C4E9C27852572F8005BBBF5/$FILE/merit_2f_insecticide_19may2008_us.pdf

Talstar

The active ingredient is bifenthrin (EPA Registration #279-3206). The produce is used to control ants (including fire ants), termites, hornets, cockroaches, mosquitoes, wasps, and other insect pests on lawns in landscaped areas and perimeters around residential, institutional, commercial, and industrial buildings, parks, and recreation areas.

Bifenthrin would be used at the NCTC to control listed species such as ants, ticks, termites, stink bugs, wasps and hornets, mosquitoes, and other insects around buildings, recreation sites, and in landscaped areas.

This product is expected to have low oral and dermal toxicity but is expected to be irritating to the skin and eyes. Studies on chronic exposure to bifenthrin at the highest exposure levels reveal that it does not cause reproductive toxicity. None of the ingredients in Talstar are known or listed carcinogens.

Bifenthrin belongs to the pyrethoid family of insecticides. Refer to "Pyrethrin" above for toxicity.

View detailed information at
http://www.cdms.net/LDat/ld8PK004.pdf

http://www.cdms.net/LDat/mp8PK003.pdf

Fungicides

Lime-Sulfur

Lime-sulfur is an inorganic (calcium) polysulfide. (EPA Registration #66196-2) It is a fungicide applied primarily in agricultural and residential settings.

Lime-sulfur would be used at the NCTC to prevent or control plant diseases such as anthracnose, black spot, powdery mildew, and scale insects.

Lime-sulfur poses no risks that require mitigation. The EPA waived all environmental fate data requirements for sulfur in 1982, based on the fact that it is a natural component of the environment.

The risks associated with exposure to sulfur appear to be low. The EPA has determined that calcium polysulfide rapidly degrades to calcium hydroxide and sulfur in the human body and poses no unacceptable risks to humans. Thus, the data requirements for the higher tier toxicity studies have been waived by the EPA.

It is possible for sulfur to oxidize to sulfuric acid and acidify soils; however, this is not considered likely to be a deleterious effect. In addition, elemental sulfur added to the environment will become incorporated into the natural sulfur cycle.

View detailed information at
http://www.epa.gov/pesticides/reregistration/REDs/inorganic_polysulfides_red.pdf

http://www.epa.gov/fedrgstr/EPA-PEST/2007/May/Day-02/p8276.htm

Daconil

The active ingredient is chlorothalonil (EPA Registration #50534-211-100). It is used to control diseases in turf and ornamental plants.

Chlorothalonil would be used at the NCTC to prevent fungus diseases such as a dogwood discula, sycamore anthracnose, leaf spot, and powdery mildew in landscape and reforestation areas.

This product is highly toxic to aquatic invertebrates and aquatic wildlife. Chlorothalonil is practically nontoxic to avian species and small mammals on an acute oral and subacute dietary basis. The bioaccumulation potential of chlorothalonil is low.

Chlorothalonil is in acute Toxicity Category IV (the least toxic of four categories) for the oral route of exposure and in Toxicity Category II for the inhalation route. For acute dermal effects and acute skin irritation, chlorothalonil is in Toxicity Category IV.

Chlorothalonil has limited potential to reach groundwater, and where it has been detected in groundwater, concentrations have been low and often attributed to atypical sources.

View detailed information at

http://www.epa.gov/oppsrrd1/REDs/factsheets/0097fact.pdf

http://www.syngentaprofessionalproducts.com/labels/default.aspx

Rodenticides

Rodex Pelleted Bait

The active ingredient is warfarin (EPA # 61282-33). Rodenticides are an important tool for public health pest control. Warfarin is an anticoagulant that was discovered in mold growing on sweet clover. Warfarin works by preventing blood coagulation, leading to death of the rodent, typically several days after ingestion. Warfarin is also prescribed as a blood thinner for people with circulatory concerns.

Warfarin would be used outdoors on rats or mice near buildings if other measures, such as trapping, are not successful or appropriate.

The EPA requires that all rodenticide bait products available for sale to consumers be used only in tamper-resistant bait stations. The reason for EPA's decision is to mitigate rodenticide exposures to wildlife because rodenticides can pose significant risks to nontarget wildlife, including birds (such as hawks and owls) and mammals, such as raccoons, squirrels, skunks, deer, coyotes, foxes, mountain lions, and bobcats. Rodenticides applied as bait products can pose risks to wildlife from primary exposure (direct consumption of rodenticide bait) and secondary exposure (predators or scavengers consuming prey with rodenticides present in body tissues).

Rodenticides can pose significant risks to children. EPA's requirement to sell rodenticides in tamper-resistant bait stations is to also decrease the incidence of children's accidental exposures (through ingestion and contact). In addition to ingestion risks, rodenticides can be slightly irritating to the eyes.

View detailed information at

http://www.epa.gov/pesticides/reregistration/rodenticides/finalriskdecision.htm

http://www.epa.gov/pesticides/reregistration/rodenticides/index.htm

http://www.hacco.com/Rodenticide_SpecLabels/Rodex%20Pelleted%20Bait-1%20(61282-33)%204-08.pdf

http://www.hacco.com/Rodenticide_MSDS/MSDS%20Rodex%20Pelleted%20Bait-1%20(61282-33)%2003-10.pdf

ERAZE Rodent Pellets

The active ingredient is zinc phosphide (EPA #12455-18-3240). Zinc phosphide is a non-anticoagulant that works by producing a toxic gas when it contacts the stomach acid of rodents

that ingest it. It works quickly and is used on rodent populations that have developed resistance to warfarin or in rotation with that product to keep resistance from developing.
Zinc phosphide would be used outdoors on rats or mice if other measures, such as trapping, are not successful or appropriate. As with other rodenticide products, the EPA requires that this pelleted bait product be used in tamper-resistant bait stations.

The EPA has determined that zinc phosphide is highly toxic to avian species on an acute oral and on a subacute dietary basis. The results from studies indicate that zinc phosphide is highly to very highly toxic to small mammals on an acute oral basis and to fish. This product must be kept away from humans, domestic animals, and pets. It is harmful if swallowed, absorbed through the skin, inhaled, or comes in contact with the eyes.

Zinc phosphide and its residues appear to be nonpersistent under most environmental conditions and relatively immobile (zinc ions and dissolved phosphorus readily sorb onto soil) in laboratory and field data. This product should not be applied directly to water or to areas where surface water is present; however, zinc phosphide and its degradation products appear to have a low potential for ground water or surface water contamination.

View detailed information at

http://www.epa.gov/oppsrrd1/REDs/0026red.pdf

http://www.epa.gov/pesticides/reregistration/rodenticides/finalriskdecision.htm

http://www.epa.gov/pesticides/reregistration/rodenticides/index.htm

http://motomco.com/pdf/Specimen_Labels/18-Eraze_Rodent_Pellets.pdf

http://motomco.com/pdf/MSDS/18-Eraze_Rodent_Pellets.pdf

Appendix F: Fire Behavior Information and Drought Summaries for Northeast West Virginia

Appendix F: Fire Behavior Information and Drought Summaries for Northeast West Virginia

NFDRS Fuel Model Definitions

The National Fire Danger Rating System (NFDRS) website is http://www.wrh.noaa.gov/sew/fire/olm/nfdrs.htm. The Fuel Model Definitions can also be found at http://www.fs.fed.us/fire/planning/nist/nfdr.htm.

The National Fire Danger Rating System - 1978 **Fuel Model Definitions**	
Fuel Model A	This fuel model represents western grasslands vegetated by annual grasses and forbs. Brush or trees may be present but are very sparse, occupying less than a third of the area. Examples of types where Fuel Model A should be used are cheatgrass and medusahead. Open pinyon-juniper, sagebrush-grass, and desert shrub associations may appropriately be assigned this fuel model if the woody plants meet the density criteria. The quantity and continuity of the ground fuels vary greatly with rainfall from year to year.
Fuel Model B	Mature, dense fields of brush 6 feet or more in height are represented by this fuel model. One-fourth or more of the aerial fuel in such stands is dead. Foliage burns readily. Model B fuels are potentially very dangerous, fostering intense fast-spreading fires. This model is for California mixed chaparral generally 30 years or older. The F model is more appropriate for pure chamise stands. The B model may be used for the New Jersey pine barrens.
Fuel Model C	Open pine stands typify Model C fuels. Perennial grasses and forbs are the primary ground fuel but there is enough needle litter and branchwood present to contribute significantly to the fuel loading. Some brush and shrubs may be present but they are of little consequence. Situations covered by Fuel Model C are open, longleaf, slash, ponderosa, Jeffrey, and sugar pine stands. Some pinyon-juniper stands may qualify.
Fuel Model D	This fuel model is specifically for the palmetto-gallberry understory-pine overstory association of the southeast coastal plains. It can be also used for the so-called "low pocosins" where Fuel Model O might be too severe. This model should only be used in the Southeast because of a high moisture of extinction.
Fuel Model E	Use this model after leaf fall for hardwood and mixed hardwood-conifer types where the hardwoods dominate. The fuel is primarily hardwood leaf litter. The oak-hickory types are best represented by Fuel Model E, but E is an acceptable choice for northern hardwoods and mixed forests of the Southeast. In high winds, the fire danger may be underrated because rolling and blowing leaves are not accounted for. In the summer after the trees have leafed out, Fuel Model E should be replaced by fuel Model R.

Fuel Model F	Fuel Model F is the only one of the 1972 NFDRS Fuel Models whose application has changed. Model F now represents mature closed chamise stands and oakbrush fields of Arizona, Utah, and Colorado. It also applies to young, closed stands and mature, open stands of California mixed chaparral. Open stands of pinyon-juniper are represented; however, fire activity will be overrated at low windspeeds and where there is sparse ground fuels.
Fuel Model G	Fuel Model G is used for dense conifer stands where there is a heavy accumulation of litter and downed woody material. Such stands are typically overmature and may also be suffering insect, disease, wind, or ice damage -- natural events that create a very heavy buildup of dead material on the forest floor. The duff and litter are deep and much of the woody material is more than 3 inches in diameter. The undergrowth is variable, but shrubs are usually restricted to openings. Types meant to be represented by Fuel Model G are hemlock-Sitka spruce, Coast Douglas-fir, and windthrown or bug-killed stands of lodgepole pine and spruce.
Fuel Model H	The short-needled conifers (white pines, spruces, larches, and firs) are represented by Fuel Model H. In contrast to Model G fuels, Fuel Model H describes a healthy stand with sparse undergrowth and a thin layer of ground fuels. Fires in H fuels are typically slow spreading and are dangerous only in scattered areas where the downed woody material is concentrated.
Fuel Model I	Fuel Model I was designed for clear-cut conifer slash where the total loading of materials less than 6 inches in diameter exceeds 25 tons/acre. After settling and the fines (needles and twigs) fall from the branches, Fuel Model I will overrate the fire potential. For lighter loadings of clear-cut conifer slash, use Fuel Model J, and for light thinnings and partial cuts where the slash is scattered under a residual overstory, use Fuel Model K.
Fuel Model J	This model complements Fuel Model I. It is for clearcuts and heavily thinned conifer stands where the total loading of materials less than 6 inches in diameter is less than 25 tons/acre. Again, as the slash ages, the fire potential will be overrated.
Fuel Model K	Slash fuels from light thinnings and partial cuts in conifer stands are represented by Fuel Model K. Typically the slash is scattered about under an open overstory. This model applies to hardwood slash and to southern pine clearcuts where the loading of all fuels is less than 15 tons/acre.
Fuel Model L	This fuel model is meant to represent western grasslands vegetated by perennial grasses. The principal species are coarser and loadings heavier than those in Model A fuels. Otherwise the situations are very similar; shrubs and trees occupy less than one-third of the area. The quantity of fuel in these areas is more stable from year to year. In sagebrush areas Fuel Model T may be more appropriate.
Fuel Model N	This fuel model was constructed specifically for the sawgrass prairies of south Florida. It may be useful in other marsh situations where the fuel is coarse and reedlike. This model assumes that one-third of the aerial portion of the plants are

	dead. Fast-spreading, intense fires can occur even over standing water.
Fuel Model O	The O fuel model applies to dense, brushlike fuels of the Southeast. O fuels, except for the deep litter layer, are almost entirely living in contrast to B fuels. The foliage burns readily except during the active growing season. The plants are typically over 6 feet tall and are often found under an open stand of pine. The pocosins of the Virginia, North and South Carolina coasts are the ideal of Fuel Model O. If the plants do not meet the 6-foot criteria in those areas, Fuel Model D should be used.
Fuel Model P	Closed, thrifty stands of long-needled southern pines are characteristic of P fuels. A 2- to 4-inch layer of lightly compacted needle litter is the primary fuel. Some small diameter branchwood is present but the density of the canopy precludes more than a scattering of shrubs and grass. Fuel Model P has the high moisture of extinction characteristic of the Southeast. The corresponding model for other long-needled pines is U.
Fuel Model Q	Upland Alaskan black spruce is represented by Fuel Model Q. The stands are dense but have frequent openings filled with usually inflammable shrub species. The forest floor is a deep layer of moss and lichens, but there is some needle litter and small-diameter branchwood. The branches are persistent on the trees, and ground fires easily reach into the tree crowns. This fuel model may be useful for jack pine stands in the Lake States. Ground fires are typically slow spreading, but a dangerous crowning potential exists. Users should be alert to such events and note those levels of SC and BI when crowning occurs.
Fuel Model R	This fuel model represents the hardwood areas after the canopies leaf out in the spring. It is provided as the off-season substitute for E. It should be used during the summer in all hardwood and mixed conifer-hardwood stands where more than half of the overstory is deciduous.
Fuel Model S	Alaskan or alpine tundra on relatively well-drained sites is the S fuel. Grass and low shrubs are often present, but the principal fuel is a deep layer of lichens and moss. Fires in these fuels are not fast spreading or intense, but are difficult to extinguish.
Fuel Model T	The bothersome sagebrush-grass types of the Great Basin and the Intermountain West are characteristic of T fuels. The shrubs burn easily and are not dense enough to shade out grass and other herbaceous plants. the shrubs must occupy at lease one-third of the site or the A or L fuel models should be used. Fuel Model T might be used for immature scrub oak and desert shrub associations in the West, and the scrub oak-wire grass type in the Southeast.
Fuel Model U	Closed stands of western long-needled pines are covered by this model. The ground fuels are primarily litter and small branchwood. Grass and shrubs are precluded by the dense canopy but occur in the occasional natural opening. Fuel Model U should be used for ponderosa, Jeffrey, sugar pine, and red pine stands of the Lake States. Fuel Model P is the corresponding model for southern pine

	plantations.

Predicted Fire Behavior System Fuel Model Definitions

Information on the Predicted Fire Behavior System can be found at http://fire.forestencyclopedia.net/p/p463.

Grass fuel models

1. grasslands and savannas (correlates to NFDRS models A, L, and S)
2. open shrub land, pine and scrub oak stands covering less than 2/3 area (correlates to NFDRS models C and T)
3. tall prairie and marshland grasses where influence of wind is high (correlates to NFDRS model N)

Shrub fuel models

4. stands of mature shrubs, closed jack pine stands (correlates to NFDRS models B and O)
5. young green stands with no dead wood such as laurel or vine maple (no model represented)
6. intermediate shrub stands and cured hardwood slash (correlates to NFDRS models F and Q)
7. stands of shrubs 2 - 6 feet such as palmetto-gallberry with pine overstory (correlates to NFDRS model D)

Timber fuel models

8. closed canopy stands of short-needle conifers or hardwoods that have leafed out and support fire in the compact litter layer (correlates to NFDRS models H and R)
9. long-needle conifer and hardwood stands (correlates to NFDRS models E, P, and U)
10. any stand with large quantities of dead-down fuel (correlates to NFDRS model G)

Slash fuel models

11. conifer or hardwood stands with light partial cuts or thinning (correlates to NFDRS model K)
12. heavily thinned conifer stands, clearcuts, medium – heavy partial cuts (correlates to NFDRS model J)
13. clearcuts and heavy partial cuts in mature stands where slash is dominated by material with diameter exceeding 3 inches (correlates to NFDRS model I)

Palmer Drought Index

The Palmer Index was developed by Wayne Palmer in the 1960s and uses temperature and rainfall information in a formula to determine dryness. It has become the semi-official drought index.

The Palmer Index is most effective in determining long-term drought — a matter of several months — and is not as good with short-term forecasts (a matter of weeks). It uses a 0 as normal, and drought is shown in terms of minus numbers; for example, minus 2 is moderate drought, minus 3 is severe drought, and minus 4 is extreme drought. The Palmer Index also reflects excess rain using a corresponding level reflected by plus figures; that is, 0 is normal, plus 2 is moderate rainfall, and so forth.

The advantage of the Palmer Index is that it is standardized to local climate, so it can be applied to any part of the country to demonstrate relative drought or rainfall conditions. The negative is that it is not as good for short-term forecasts and is not particularly useful in calculating supplies of water locked up in snow, so it works best east of the Continental Divide.

The Crop Moisture Index, or CMI, is a formula that was also developed by Wayne Palmer subsequent to his development of the Palmer Drought Index. The Crop Moisture Index responds more rapidly than the Palmer Index and can change considerably from week to week, so it is more effective in calculating short-term abnormal dryness or wetness affecting agriculture.

The Crop Moisture Index is designed to indicate normal conditions at the beginning and end of the growing season; it uses the same levels as the Palmer Drought Index. It differs from the Palmer Index in that the formula places less weight on the data from previous weeks and more weight on the recent week.

The above information was taken from http://www.drought.noaa.gov/palmer.html. The information in the following two tables are for northeastern West Virginia. Data is also available for the entire state at the websites noted below. The first table below shows that the most recent extreme drought conditions occurred over a 16-month period from November 1998 to February 2000.

Northeastern West Virginia Drought Periods

The below table show periods of two or more months of severe or extreme drought conditions. The data are based on the monthly Palmer Drought Severity Index (PDSI) as computed by the National Climatic Data Center. The period of record runs from January 1895 through September 2010.

Sources: http://www.nrcc.cornell.edu/drought/WV_drought_periods.html
http://wv.usgs.gov/drought/

-- Northeastern West Virginia Climate Division --		
Drought Periods	**Duration**	**Lowest PDSI**
11/1895 - 2/1896	4 months	-4.56 in 1/1896
4/1896 - 6/1896	3 months	-4.24 in 5/1896
12/1899 - 1/1900	2 months	-3.53 in 1/1900
8/1900 - 2/1901	7 months	-5.03 in 2/1901
11/1909 - 12/1909	2 months	-3.37 in 12/1909
3/1910 - 5/1910	3 months	-3.66 in 3/1910
10/1910 - 3/1911	6 months	-3.81 in 12/1910
5/1911 - 7/1911	3 months	-3.97 in 7/1911
7/1930 - 7/1931	13 months	-7.14 in 2/1931
10/1931 - 2/1932	5 months	-4.30 in 12/1931
11/1953 - 5/1954	7 months	-4.25 in 2/1954
11/1965 - 3/1966	5 months	-4.58 in 12/1965
5/1966 - 8/1966	4 months	-5.23 in 8/1966
4/1969 - 7/1969	4 months	-4.37 in 6/1969
10/1969 - 11/1969	2 months	-3.34 in 11/1969
8/1991 - 2/1992	7 months	-4.42 in 11/1991
11/1998 - 2/2000	16 months	-4.79 in 8/1999

West Virginia Drought Summary
Percent of Time Spent in Drought Categories

The following data are based on the monthly Palmer Drought Severity Index (PDSI) as computed by the National Climatic Data Center. "Cumulative" is the percent of time in a given category plus all preceding categories.

Sources: http://www.nrcc.cornell.edu/drought/WV_pdsi_smry.html
http://www.nrcc.cornell.edu/page_drought.html

-- Northeastern West Virginia Climate Division --		
PDSI Category	**Percent of Time in Category**	**Cumulative Percent Time**
Extreme	2.7	2.7
Severe	4.5	7.2
Moderate	11.2	18.4
Mild	15.3	33.6
Incipient	11.4	45.0
Near Normal	16.5	61.5
Wet	38.5	100.0
Lowest PDSI in 1389 months (about 116 years, 1894 – 2010)	-7.14 in 2/1931	