

## Chapter 4



Steve Hillebrand/USFWS

*Bald eagle*

# Environmental Consequences

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## 4.1 Introduction

This chapter describes the foreseeable environmental consequences we predict from implementing the refuge management alternatives presented in chapter 3. Specifically, we predict the beneficial and adverse impacts of implementing the management actions and strategies for each of the three alternatives:

- Alternative A—Current Management (No Action Alternative), which serves as a baseline for comparing against the other alternatives.
- Alternative B—Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative).
- Alternative C—Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities.

In this chapter we describe the impacts likely to occur over the 15-year life span of this CCP. Beyond the 15-year planning horizon, we give a more approximate description of environmental consequences. Where detailed information is available, we present a scientific and analytic comparison of the alternatives and their anticipated impacts and effects on the environment. When detailed information is not available, we base those comparisons on our professional judgment and experience. At the end of this chapter, table 4.2 summarizes the impacts predicted for each alternative and provides a side-by-side comparison. Our discussion also relates the predicted impacts of the alternatives to the refuge goals and the key issues identified in chapter 1.

Regulations adopted by the CEQ and by the Service on implementing NEPA require that we assess the significance of the impacts of all alternatives, based on impact type, context, duration, and intensity. CEQ regulations also that requires agencies to “integrate the NEPA process with other planning at the earliest possible time to insure that planning and decisions reflect environmental values, to avoid delays in the process, and to head off potential conflicts.” Throughout development of this draft CCP and EA, we have made a concerted effort to integrate Section 106 compliance procedures into our NEPA review. We use Section 106 terminology to characterize effects on cultural resources in section 4.15.

The following terminology is used throughout the natural and human environment impact discussions.

The type of impact from a particular management action may be either beneficial or adverse. A “beneficial” impact is one that results in positive change in the condition or appearance of the resource, or a change that moves the resource toward a desired condition. An “adverse” impact results in a negative change in the condition or appearance of the resource, or a change that moves the resource toward an undesirable condition. When possible, we identify specific ways we would decrease the intensity of the adverse impact. The impact type may also be either direct or indirect. A direct impact is one that results from an action and occurs at the same time and place. An indirect impact results from an action but occurs later in time or is farther removed in distance. Both beneficial and adverse impacts may be direct or indirect.

The context of our impact analysis covers site-specific, regional, and landscape-scale impacts, depending on how widely the effect of an action can be observed. Certain actions (such as improvement of an existing public use facility) may have impacts only in a local context, while others (such as protection of bald eagle nesting habitat throughout its range) may have impacts in a much broader context. It is important to note that local actions may have cumulative impacts in a larger context when combined with other actions. For example, increased sediment loading in to local waterways, when combined with other increased nutrient loads in waterways throughout the watershed, could result in combined, significant cumulative effect by impairing water quality of the James River and Chesapeake Bay watersheds. We developed the three management alternatives to contribute toward local, regional, and national conservation goals. Our proposed conservation objectives and strategies for species and habitats are consistent with plans identified in chapter 1.

Regarding intensity and duration, impacts can be described as negligible, minor, moderate, or major. The definitions of these terms, for the purposes of this CCP, are as follows:

- Negligible—Management actions would result in impacts that would not be detectable or, if detected, would have impacts that would be considered slight, localized, and short term.
- Minor—Management actions would result in a detectable change, but the change would be slight and have only a local impact on the community, the resource, or ecological processes. The change would be discountable, insignificant, and of little consequence and short term in nature.
- Moderate—Management actions would result in a clearly detectable change. This could include changes to a local biotic population or habitat sufficient to cause a change in abundance, distribution, or composition, but not changes that would affect the viability of regional populations or habitats. Changes to local ecological processes would be of a limited extent.
- Major—Management actions would result in a clearly detectable change. The impacts would be substantial and highly noticeable and could result in widespread change. This could include changes in the abundance, distribution, or composition of local or regional populations or habitats to the extent that it would not likely recover or continue in its previous condition or size. Significant ecological processes would be altered, and changes throughout the ecosystem would be expected.

The duration of identified impacts and their consequences also varies, from those occurring only once for a brief period in the 15-year period of this plan, like the construction impacts from expanding existing facilities, to those occurring more frequently during the year, like thinning or invasive species control. The environmental consequences analysis provided in this chapter also furnishes the level of detail necessary to assess the compatibility of all proposed uses. The duration of identified impacts and their consequences varies, ranging from the short term, which includes those activities that last for a matter of days or weeks (such as noise from construction) to long term, which are permanent activities (such as structure removal).

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We based our evaluation of the intensity of the impacts from implementing the alternatives on these factors:

- The expected degree or percent of change in the resource from current conditions.
- The frequency and duration of the effect.
- The sensitivity of the resource to such an effect, or its natural resiliency to recover from such an effect.
- The potential for implementing effective preventive or mitigating measures to lessen the effect.

For this analysis we assume that the baseline is the condition of the refuge as of mid-2013. Alternative A, which describes the current management of the refuge, assumes little change in current habitat condition, with no change to public access or infrastructure. Alternative B assumes the Service would undertake management activities to transition the pine-dominated forest towards a pine savanna, and would increase the amount and type of public uses on the refuge, as well as make the refuge more accessible to visitors in general. Alternative C assumes the Service would undertake management activities that would over time replace the pine-dominated forest with an oak/hickory/pine forest, and would expand the non-forested upland habitat. This alternative would further expand public uses, allowing for more hunting and fishing opportunities.

We do not fully evaluate the environmental impacts of certain proposed projects in this chapter. These include aspects of management that are common to all alternatives and do not individually or cumulatively have a significant effect on the quality of the human environment. The following would qualify for exclusion under the Service's list of categorical exclusions (as listed in 516 DM 8.5A), if individually proposed:

- Environmental education and interpretive programs (unless major construction is involved or significant increase in visitation is expected).
- Research, resource inventories, monitoring, and other resource information collection.
- Operations and maintenance of existing infrastructure and facilities (unless major renovation is involved).
- Certain minor, routine, recurring management activities and improvements.
- Small construction projects (e.g., fences, kiosks, and interpretive signs).
- Native vegetation planting and invasive plant control.
- Minor changes in amounts and types of public use.
- Issuance of new or revised management plans when only minor changes are planned.

- Law enforcement activities.

We recognize that we cannot fully address all the potential consequences involved with several management alternatives through this planning process. We describe in chapter 3, under section 3.3.8 “Additional NEPA Analysis,” those future management decisions that may require more detailed analysis before a choice is made. We attempt to analyze the impacts of some of the available choices in this document to the extent possible, but a more detailed analysis will be required to inform the final choice. For specific projects evaluated in the future, NEPA documents would be prepared that address and fully analyze the potential consequences. Our goal is to develop and implement all future plans to minimize the impact to each resource while maximizing the long-term benefit to each resource. Each additional NEPA analysis will include compliance with Federal laws and mandates including the Endangered Species Act, the NHPA, and the Coastal Zone Management Act.

Although not a comprehensive list, we recognize that further analysis would be required for these projects and outcomes:

- Developing a LPP with appropriate NEPA documentation to meet habitat needs for trust species and to contribute to the network of conservation lands and wildlife resources in the regional landscape by expanding the refuge’s acquisition boundary.
- Improving or removing existing facilities and construction of new facilities.
- Expanding the existing hunt program and adding new hunting opportunities for adults and youth.
- Removing nuisance wildlife through lethal and non-lethal methods, if deemed necessary.

## 4.2 Chapter Organization

The chapter is organized as follows:

- Air Quality.
- Water Resources.
- Soils.
- Vegetation– Forested Habitats.
- Vegetation–Non-forested Habitats
- Birds.
- Fisheries.
- Mammals.

- Amphibians and Reptiles.
- Invertebrates.
- Public Use and Access.
- Socioeconomic Environment.
- Cultural and Historic Resources.

Under each heading, we discuss impacts on each of the resource or program areas considered. Our discussion begins with impacts that would not vary by alternative, meaning that those impacts are common to all alternatives. This discussion is followed by the benefits and adverse impacts of each of the alternatives. We examine the impacts of current and proposed administrative or general operations, habitat management, and visitor services/public uses on each of the physical, biological, and cultural resources noted above.

A matrix table at the end of this chapter (table 4.2) is a summary of the impacts associated with the different approaches to delivering refuge wildlife and habitat conservation actions and providing public access and recreational uses. It compares the impacts associated with current management (alternative A), the Service-preferred alternative (alternative B), and alternative C. All three alternatives seek to conserve wildlife and their associated habitats and provide quality recreational and educational opportunities for visitors.

We end the chapter with discussions on:

- Cumulative Impacts.
- The Relationship Between Short-Term Uses of the Human Environment and Enhancement of Long-Term Productivity.
- Unavoidable Adverse Impacts.
- Potential Irreversible and Irrecoverable Commitments of Resources.
- Energy Efficiency.
- Environmental Justice.

### 4.3 Air Quality

We evaluated the management actions and the public uses that each alternative proposes for their impacts on air quality over both the short and long term. We evaluated and compared the alternatives based on their potential to provide air quality benefits, specifically keeping the same amount of refuge acreage in vegetative cover.

We also evaluated and compared the impacts of refuge management actions with the potential to cause adverse impacts to air quality, including:

- Forest management activities.
- Invasive species management techniques.
- Refuge construction projects.
- Changes in recreational use.

#### **4.3.1 Air Quality Impacts That Would Not Vary by Alternative**

As described in chapter 2, during 2012 the air quality in the region that includes James River NWR was characterized as “good,” the highest rating, between 90 to 100 percent of the time. None of our proposed management activities would result in long-term local or regional air quality impacts that would adversely impact this status, nor would they alter the status of Charles City, Henrico, Hanover, Chesterfield, and Prince George Counties as areas within an ozone maintenance and emission control area for oxides of nitrogen and volatile organic compounds.

Each of the alternatives would involve the following activities that could have localized, short-term impacts on air quality:

- Emissions from mechanical equipment used for forest management activities.
- Applying herbicides to control invasive plants.
- Blowing dust from construction sites, roads, and trails.
- Prescribed burning.

While the degree to which the management activities described in the CCP would potentially result in slightly different degrees of impacts, under each of the alternatives the Service would adhere to State and Federal standard safety regulations for weather conditions, as required. Regular updates to the refuge’s prescribed fire plan would incorporate changes that may occur to applicable Federal or State regulations, or to recommended mitigation strategies and techniques.

According to the 2013-2016 Prescribed Fire Plan for James River, the refuge is currently in compliance with regard to managing the impacted area, employing the appropriate mitigation strategies, and using techniques to reduce impacts (USFWS 2013b). We would continue to follow these guidelines under any of the alternatives.

We would also ensure that any management actions would not result in being noncompliant with the State’s smoke management plan.

As needed, we would consult with the following offices to be protective of air quality in the refuge vicinity:

- VDEQ’s Division of Air Program Coordination for guidance regarding refuge activities that have the potential to adversely impact air quality in the vicinity.

- VDEQ's Piedmont Regional Office to acquire permits for boilers or fuel-burning equipment.

Regardless of the alternative selected, we would implement refuge management activities in compliance with the Clean Air Act, and none of the alternatives would violate EPA standards for criteria air pollutants. As necessary, we would consult with VDEQ for guidance and permit requirements.

### **Beneficial Impacts**

#### *Habitat Protection and Management*

Each of the management alternatives would retain 4,324 acres within the refuge boundary as a primarily forested habitat, which would result in negligible, long-term impacts with regard to carbon sequestration, air filtration, and heat island mitigation.

With the exception only of the pine-dominated forest and non-forested upland, all management activities would continue to result in the same impacts for all the habitats present on the refuge. We would not create any new permanent sources of emissions by implementing any of the alternatives.

#### *Public Use and Access*

None identified.

### **Adverse Impacts**

#### *Habitat Protection and Management*

Each of the alternatives would result in negligible, short-term impacts from prescribed fire activities conducted to control invasive plants and manage the forest communities. The major pollutants from prescribed burning are particulates and gases. Particulates, which consist of small particles of ash, partly consumed fuel, and liquid droplets can reduce visibility or cause negative impacts on the health of people with respiratory illnesses. The gases released by prescribed burns include carbon monoxide, carbon dioxide, hydrocarbons, and small quantities of nitrogen oxides. However, low-intensity prescribed burning, which would be used on the refuge, releases inconsequential amounts of these gases (USDA 1989). We would follow prescribed burn plans, which consider smoke management and other environmental and geographical factors, to minimize impacts on surrounding areas. Based on our experience, we expect prescribed burning to produce no major, long-term adverse impacts.

#### *Public Use and Access*

Localized increases in emissions from visitor vehicles would be negligible, and any adverse air quality impacts from refuge activities would be more than offset by the benefits of maintaining the refuge in natural vegetation. We would continue to require non-motorized use of trails for wildlife observation, photography, environmental education, and interpretation.

## **4.3.2 Air Quality Impacts of Alternative A**

### **Beneficial Impacts**

Same as the impacts that do not vary among alternatives.

**Adverse Impacts**

Same as the impacts that do not vary among alternatives.

**4.3.3 Air Quality Impacts of Alternative B**

**Beneficial Impacts**

Same as the impacts that do not vary among alternatives.

**Adverse Impacts**

*Habitat Protection and Management*

Under alternative B, we would increase the frequency of forest management activities in this habitat as compared to alternative A, to occur more often on an annual basis than under current management. The two management elements that would change would include increased thinning of pine trees and more frequent prescribed burns.

Increased thinning would potentially result in moderate, indirect, long-term impacts with regard to carbon sequestration. We would reduce the tree density to 200 trees per acre within the life of the CCP and to between 80 to 100 trees per acre over the next 30 years to achieve a pine savanna density, focusing on reducing young, small pines primarily to promote growth and development of fewer, larger pine trees, for long-term habitat benefits. However, thinning can potentially result in reduced carbon sequestration benefits, due to the removal of trees and thus the reduction of the “sink” capacity of the forest. Thinning can also potentially increase carbon release through the machinery used in thinning, as well as from tree decay releasing previously trapped carbon into the atmosphere (Finkral and Evans 2008). Experiments looking at Douglas fir and loblolly pine found that for these two species, thinning may cause a decrease in carbon storage, but that there is an exception to this when thinning very dense young stands (Schroeder 1991). We would thin trees on a schedule that would remove the least number of trees while still achieving long-term habitat goals to protect the carbon sequestration benefits of the habitat to the extent feasible.

Throughout the life of the plan, we would be conducting prescribed burns annually as an additional maintenance tool. We would be conducting these more frequently under alternative B as compared to current management to help achieve the pine savanna habitat over the long term. We would continue to conduct these burns in compliance with regulations. We anticipate that the adverse impacts from this activity would be similar to those experienced under current management, which are limited, short term, and localized.

The increase in thinning and prescribed burns would result in a slight increase in vehicular traffic on the refuge, from the increase in staff numbers and times on the refuge to conduct habitat management activities. This slight increase in vehicles may have a negligible increase in associated vehicle emissions, but these would be short term and localized.

Under alternative B, we would increase our acreage of non-forested upland by approximately 2 acres. This increase in acreage would be mown annually, as is currently conducted on the existing non-forested upland acres. This minor increase in non-forested upland acres is not anticipated to result in air emissions from mowing equipment that are distinguishable from alternative A.

#### *Public Use and Access*

Alternative B includes improving the canoe/kayak launch, which would require providing parking for the vehicles for those staff making these improvements. This project would require limited equipment that would potentially have air impacts, but these would be negligible, minor, and short term, as they would be limited just to the time when the minimal construction activity needs to occur. As mentioned under section 3.3.8, additional NEPA review may be needed for proposed construction projects, which would include a detailed analysis of air quality impacts. In addition, this work would require a contractor and involve one or two vehicles traveling to and parked at the refuge during a short period of time. As a result, this would not result in any new permanent emission sources, and the minor increase in vehicle emissions would be short-term and localized.

Public use opportunities would be increased under alternative B, including the addition of more hunting opportunities, opening the refuge to fishing, and providing more open access to the other four priority uses. All of these activities are anticipated to increase the number of visitors to the refuge. This increase in visitor activity would result in increased vehicular traffic on the refuge, from visitors traveling to, from, and within the refuge. In addition, increased visitation and public access infrastructure would require an increased staff presence for maintenance and law enforcement activities and, as a result, involve one or two vehicles traveling to and parking at the refuge on a weekly basis. However, given the current air quality status of the refuge, impacts are not anticipated to be significant from the increase in visitation. Any emission increases would be direct, minor, localized, and short term.

### **4.3.4 Air Quality Impacts of Alternative C**

#### **Beneficial Impacts**

Same as the impacts that do not vary among alternatives.

#### **Adverse Impacts**

##### *Habitat Protection and Management*

Under alternative C, we would conduct selective clear cutting in dense stands, thinning, and herbicide application to reduce the dense stands of young, small pines and promote the growth and development of fewer, larger pine trees, to achieve the long-term goal of an oak/hickory/pine habitat.

We would reduce no less than 80 percent of trees in the pine-dominated forest down to a density of less than 10 stems per acre to achieve a transitional dry hardwood forest. Thinning and selective clear cutting can potentially result in reduced carbon sequestration benefits, due to the removal of trees and thus the reduction of the “sink” capacity of the forest. Thinning and selective clear cutting can also potentially increase carbon release through the machinery used in thinning, as well as from tree decay releasing previously trapped carbon into the atmosphere (Finkral and Evans 2008). Experiments looking at Douglas-fir and loblolly pine found that for these two species, thinning may cause a decrease in carbon storage, but that there is an exception to this when thinning very dense young stands (Schroeder 1991). Adverse impacts from thinning may be offset by the reducing the threat from wildlife, which would have greater carbon impacts (Finkral and Evans 2008). We would thin trees on a schedule that would remove the least number of trees while still achieving long-term habitat goals, to protect the carbon sequestration

benefits of the habitat to the extent feasible.

Throughout the life of the plan, we would be conducting prescribed burns as an additional maintenance tool. While we would continue to conduct burns between late winter and late spring, we would be conducting prescribed burns less frequently, burning either once or twice after a unit has been thinned and then not burning again until 15 to 20 years later, when the trees are large enough to withstand fire. We would continue to conduct all prescribed burns in compliance with regulations. We anticipate that the adverse impacts from this activity on air quality would be negligible, indirect, and short term.

Adverse impacts on air quality related to increased vehicular traffic in support of habitat management activities would be similar to alternative B.

Adverse impacts on air quality related to increasing our acreage of non-forested upland from 13 acres to approximately 57 acres would be similar to alternative B.

#### *Public Use and Access*

Adverse impacts on air quality related to improving facilities supporting visitor use would be similar to alternative B, even though alternative C includes construction of a new 2-mile wildlife drive.

Adverse impacts on air quality related to increased vehicular emissions generated by refuge visitors participating in the expanded public use opportunities would be similar to alternative B.

## **4.4 Water Resources**

We evaluated and compared the alternatives based on their potential to help maintain and improve the water resources on the refuge, including the wetlands, rivers, ponds, and vernal pools of the James River watershed and Chesapeake Bay Estuary. We evaluated the benefits of actions that would protect, restore, maintain, or improve water resources including:

- Shoreline protection and restoration.
- Implementing best management practices to protect soils and vegetation.
- Plant and maintain vegetation in riparian areas.

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

- Forest management activities.
- Use of herbicides to manage invasive species.
- Refuge construction projects.
- Changes in recreational use.

#### 4.4.1 Water Resources Impacts That Would not Vary by Alternative

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

As needed, we would consult with the following offices to be protective of land and water quality in the refuge vicinity:

- VDCR Regional Office to ensure compliance with State law and regulations:
  - ❖ Virginia erosion and sediment control law and regulations.
  - ❖ Virginia stormwater management law and regulations (including coverage under the general permit for stormwater discharge from construction activities).
  - ❖ Other applicable Federal nonpoint source pollution mandates (e.g., Section 313 of the Federal Clean Water Act, Federal Consistency under the Coastal Zone Management Act).
- VDCR's Division of Stormwater Management, Local Implementation Office regarding:
  - ❖ Administration of the coastal lands management enforceable policy of the Virginia Coastal Management Program for construction activities involving land-disturbing activities greater than or equal to 2,500 square feet in areas.
  - ❖ Requirement to register for coverage under the general permit for discharges of stormwater from construction activities.
  - ❖ Development of a project-specific stormwater pollution prevention plan. The plan must be prepared prior to submission of the registration statement for coverage under the general permit, and it must address water quality and quantity in accordance with the Virginia Stormwater Management Program permit regulations.
  - ❖ Erosion and sediment control and stormwater management requirements for RPAs.
  - ❖ Best management practices for minimizing land disturbance and impervious cover, as well as the protection of native vegetation to the maximum extent practicable.
- VDEQ Division of Water Quality Programs, Office of Wetlands and Water Protection/Compliance regarding:
  - ❖ Water regulations.
  - ❖ A variety of permits, including:
    - Virginia Pollutant Discharge Elimination System permit.
    - Virginia pollution abatement permit.

- Surface and groundwater withdrawal permit.
- Virginia water protection permit which governs wetlands, surface water, and surface water withdrawals/ impoundments, and serves as § 401 certification of the Federal Clean Water Act § 404 permits for dredge and fill activities in U.S. waters.
- Virginia Department of Health, Office of Drinking Water regarding:
  - ❖ Project review for the potential to impact public drinking water sources (groundwater wells, springs, and surface water intakes).
  - ❖ Requirements and permits related to refuge drinking water sources and facilities.
- VDEQ's Division of Land Protection and Revitalization regarding:
  - ❖ Solid or hazardous waste management strategies, including items such as facility siting, long-term (20-year) use and alternative programs (e.g., materials recycling and composting).
- VMRC regarding:
  - ❖ Projects that involve encroachments channel-ward of ordinary high water along non-tidal rivers and streams, and below mean low water in tidal regions.
  - ❖ Permit requirements for impacts to tidal wetlands.

As needed, we would consider the following recommendations from the VDEQ regarding land-disturbing activities:

- Maximize pervious surfaces and green spaces in the construction design to reduce runoff and the environmental impacts thereof.
- Protect indigenous vegetation to the maximum extent practicable by minimizing land disturbance and impervious cover.
- Meet all erosion and sediment control and stormwater management requirements for all construction activities as defined by Prince George County's erosion and sediment control ordinance (Prince George County 2001).
- The Service or its agents must prepare an erosion and sediment control plan for review by the VDCR Regional Office serving the project area.
- Any soil suspected of contamination, or wastes that are generated during construction, must be tested and disposed of in accordance with applicable laws and regulations, including the Virginia Hazardous Waste Management Regulations (9 VAC 20-60) and the Virginia Solid Waste Management Regulations (9 VAC 20-80).
- The Service or its agents are responsible for determining whether a solid waste meets the criteria for management as a hazardous waste and, therefore, be managed as such.

- Acquire permit(s) from VMRC for projects that will impact tidal wetlands.
- The Service is ultimately responsible for achieving project compliance through oversight of on-site contractors, regular field inspection, prompt action against non-compliant sites, and other mechanisms consistent with agency policy. (VESCL §10.1-567).
- Clearing and grading activities, installation of staging areas, parking lots, roads, buildings, utilities, borrow areas, soil stockpiles, and related land-disturbing activities that result in the disturbance of 2,500 square feet or more of land are regulated by Virginia erosion and sediment control laws and regulations.
- Erosion and sediment controls and best management practices should be inspected and repaired before and after rain events.

### **Beneficial Impacts**

#### *Habitat Protection and Management*

Implementing best management practices during thinning, prescribed burning, and construction activities would result in moderate, direct, long-term impacts to refuge water resources because we would actively be preventing soil and chemicals from entering into waterways. Management activities such as prescribed burning, herbicide application, and land disturbance have the potential to impact water resources through erosion and sedimentation and the transport of chemicals in stormwater or in groundwater. We would require all activities conducted by refuge staff to implement best management practices. Activities such as thinning, constructing refuge facilities and infrastructure, and applying herbicides would in some cases be completed by outside contractors. We would require the same level of best management practice implementation by contractors as by Service staff. To protect water resources, refuge staff would be on-site during land disturbing and herbicide application activities to ensure compliance and proper application of best management practices.

Informal monitoring of the erosional bluff habitat by refuge staff would provide minor, indirect, short-term impacts to erosional bluff habitat because we would be able to keep informed on the condition of the habitat and identify any noteworthy changes. Under all alternatives, we would continue to monitor erosional bluff habitat on the refuge. At a minimum, informal monitoring would occur when staff would be on-site performing other refuge activities such as bald eagle surveys or from a boat when conducting refuge tours. Collected information would allow us to understand the condition of the erosional bluff habitat and implement the appropriate management actions as refuge resources allow. Informal monitoring would also allow us to collect information on the performance of best management practices involved with ground disturbing activities and herbicide applications in other habitats and their ability to protect erosional bluff habitat.

#### *Public Use and Access*

None identified.

### **Adverse Impacts**

#### *Habitat Protection and Management*

The use of heavy equipment to complete tree removal activities in the pine-dominated forest habitat and construction of refuge infrastructure and facilities would result in minor, indirect, short-term impacts to water resources because construction and some tree removal activities would require land disturbance to occur. We would minimize the impacts to land disturbing activities by implementing best management practices for forest thinning and tree removal. Recommended best management practices would include pre-harvest planning, careful designing of roads and other activities that expose bare soil, minimizing trafficking and areas of bare soil, maintaining vegetation along streams (often referred to as streamside management zones), rapidly revegetating following harvesting, minimizing soil disturbance in general, and ameliorating vehicular traffic with site preparation (Aust and Blinn 2004). The application of these best management practices have been shown to minimize the impacts from forest management activities to water quality. In addition, few forest management activities would take place within riparian habitat, further minimizing impacts.

Under all alternatives, we would limit timing of tree removal activities to areas when and where the seasonal conditions, soil type, and topography would minimize the potential for land disturbing activities to result in erosion that transports sediment into the water resources of the refuge. The refuge has an established spill prevention and response plan in place (USFWS 2001). This plan outlines measures to prevent spills from activities, such as refueling of equipment, equipment maintenance, and herbicide application. The plan also outlines protocols to implement in the event of an accident resulting in a spill to minimize the migration of chemicals into waterways. We would require all refuge staff and outside contractors to comply with this spill plan and any project or activity-specific actions required to minimize the potential of a spill adversely impacting water resources on the refuge and the James River watershed.

#### *Public Use and Access*

None identified.

### **4.4.2 Water Resources Impacts of Alternative A**

#### **Beneficial Impacts**

Same as the impacts that do not vary among alternatives.

#### **Adverse Impacts**

Same as the impacts that do not vary among alternatives.

### **4.4.3 Water Resources Impacts of Alternative B**

#### **Beneficial Impacts**

#### *Habitat Protection and Management*

Monitoring shoreline conditions and bank loss within the refuge would provide minor, indirect, short-term impacts to water resources within the refuge because observations and data would be used for future planning when determining site-appropriate shoreline stabilization technique and planting options. Shoreline and bank erosion has been shown to be one of the most important sources of sediment to water resources, both in Virginia and the U.S. (USGS 2003). Collecting information on the condition and rates of

erosion on the shorelines and stream banks would allow us to understand how severe the problem is, and what stabilization techniques would be appropriate given the site conditions.

*Public Use and Access*

Same as the impacts that do not vary among alternatives.

**Adverse Impacts**

*Habitat Protection and Management*

Same as the impacts that do not vary among alternatives.

*Public Use and Access*

Development of public use facilities and infrastructure (improving the canoe/kayak launch, installing a wildlife observation platform and fishing platform, enhancing the 3-mile nature trail, and improving the parking) would result in minor, direct, short-term impacts to water quality of local waterways because the construction of the facilities would require land disturbance and the operation of the facilities would increase impervious surfaces and water use within the refuge. To minimize impacts, we would avoid siting facilities near waterways, wetlands, or steep slopes. Where structures are to occur near waterways, wetlands, or steep slopes, best management practices will be utilized. We would require the design of facilities and improvements to consider minimizing the amount of impervious surface area and incorporating alternative design elements, such as rain gardens and permeable paving, to offset water resource impacts. Water use would be minimized by designing restroom facilities that are water and energy efficient, such as low flow or composting toilets. As discussed earlier, we would require best management practices during construction to prevent or minimize sediment generated from construction activities ending up in waterways. We would also monitor site conditions following construction to make sure that long-term best management practices, such as re-vegetation or water retention facilities, were operational and functioning properly.

Improving the canoe/kayak launch, which also includes access to fishing, would result in negligible, direct, short-term impacts because anglers or kayakers may stir up the sediment on the bottom of Powell Creek or introduce pollutants into the waterways. Re-suspension of bottom sediments would result in increased turbidity and as a result water clarity would decrease. With decreased water clarity, SAV in Powell Creek would be adversely impacted because light penetration would be reduced. Re-suspension of bottom sediments would also result in increased nutrient availability, which might make algal blooms more present. We anticipate the adverse impact to water resources due to anglers and canoe/kayak users would be negligible because of the type of watercraft the launch would be designed for and because the number of potential users would be limited by available parking spaces.

**4.4.4 Water Resources Impacts of Alternative C**

**Beneficial Impacts**

*Habitat Protection and Management*

Same as the impacts detailed under alternative B.

*Public Use and Access*

Same as the impacts that do not vary among alternatives.

### **Adverse Impacts**

#### *Habitat Protection and Management*

Converting the pine-dominated forest to a transitional dry hardwood forest would result in minor to moderate, indirect, short-term impacts to water resources because the amount and frequency of tree removal activities would be increased under alternative C as compared to alternatives A and B. This increase in tree removal activities would result in increased land disturbance and the exposure of bare soils. We would minimize the impacts to land disturbing activities by implementing best management practices for forest thinning and tree removal, emphasizing pre-harvest planning, and carefully designing roads and other activities that expose bare soil. In addition, few forest management activities would take place within riparian habitat, further minimizing impacts.

Controlling the pine seed bank while converting the pine-dominated forest to a transitional dry hardwood forest would result in minor to moderate, direct, short-term impacts to water resources because the amount and frequency of herbicide applied to this habitat would be increased under alternative C as compared to alternatives A and B. As discussed in other sections, to achieve the desired habitat conditions, an intensive herbicide application program would be required during the conversion of the pine-dominated forest. We would minimize the potential for impacts by requiring the use of only approved herbicides at the recommended rates and concentrations and following best management practices for herbicide application.

#### *Public Use and Access*

Adverse impacts on water resources related to increased infrastructure and associated public use would be similar to alternative B, even though alternative C includes developing a 2-mile wildlife drive and a third fishing location. We would utilize the same avoidance and minimization techniques for all activities associated the construction and operation of public use facilities that are discussed under alternative B to prevent adverse impacts to the water resources of the refuge.

## **4.5 Soils**

We evaluated and compared the management actions proposed under each alternative on the basis of their potential to benefit or adversely affect soils.

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

- Following best management practices for soils protection and containment.
- Limiting public access through permits and designating trails.
- Plant and maintain vegetation in riparian areas.

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

- Construction activities.
- Forest management activities.
- Public uses, such as walking on trails and hunting.

#### 4.5.1 Soils Impacts That Would not Vary by Alternative

##### **Beneficial Impacts**

###### *Habitat Protection and Management*

Maintaining natural land cover throughout refuge habitats would continue to provide moderate, direct, long-term impacts to the refuge's soils because this condition would continue to help prevent erosion and keep existing soil resources in place. Conversion of land from vegetated land cover to agricultural use or urbanized development has been shown to be one of the main causes of soil loss, both in Virginia and across the U.S. (U.S. EPA 1992, Gellis and Noe 2013). In plot studies, areas with the lowest percent ground cover showed the most erosion effect in large rain events (Ghahramani et al. 2011). By maintaining natural land cover, the vegetation and its root structure would continue to help keep the soil in place.

Continuing to maintain native tree species along the refuge shoreline of erosional bluff would provide minor, direct, long-term impacts to soils of the refuge because trees would help prevent and reduce erosion within a habitat that has inherently unstable soils due to soil composition, slope, and direct influence of the James River. As discussed in impacts related to erosional bluff habitat, maintaining trees and limiting equipment use in this area are best management practices that would protect vegetation and the soils of the refuge.

###### *Public Use and Access*

None identified.

##### **Adverse Impacts**

###### *Habitat Protection and Management*

Exposed bare soil from upland locations, such as the pine-dominated forest, during forest management activities would have a negligible, direct, short-term impact on refuge soils because the soil may become airborne and form dust or be transported to other locations on the refuge or into waterways through erosion. We would continue to employ forest best management practices to protect the existing vegetation, which would also protect soils. Logging decks would be the areas where the most intense land disturbance would occur because these sites would be used to handle and store logs from other areas within the pine-dominated forest; this activity from above looks similar to a wheel, where these areas would be the hub and the areas where cutting occurs are the wheel spokes. Planting native grasses within the logging deck areas after thinning operations end would help to minimize the impacts to land disturbance. We would continue to implement the prescribed burn plan for the refuge to minimize and mitigate impacts from prescribed burning (USFWS 2013). We would limit heavy equipment in or near waterways and moist habitat types to prevent disturbance or rutting to soils. We would also limit the timing of tree removal activities to areas when and where the seasonal conditions, soil type, and topography would minimize the potential for unnecessary soil disturbance.

Thinning and selective clear cutting activities would result in minor, direct, short- and long-term impacts to refuge soils through nutrient release, specifically nitrogen and carbon loss to the atmosphere. In the absence of thinning and fire, forest habitats accumulate and recycle nutrients through forest soils. Organic carbon builds up and is stored in soils as litter breaks down with the help of invertebrates and microbial activity. Thinning would have the potential to reduce nutrient and carbon inputs into the soil by stimulating decomposition rates and reducing litterfall. However, Johnson et al. (2002) found no lasting impact on carbon in the soil following harvesting after 15 to 16 years. In one study, total carbon and total nitrogen levels returned to greater than 90 percent of pre-harvest levels within 2 years after harvest (Carter et al. 2002).

Prescribed burning would result in negligible to minor, direct, short-term impacts to refuge soils because prescribed burning results in an immediate, temporary reduction of understory and ground vegetation, which helps to protect soils from wind and water erosion. Following a prescribed burn, there would be a reduction in the amount of understory and ground vegetation, one of the objectives of the treatment. However, prescribed burns are planned and conducted so as to not remove all the existing forest litter. In most prescribed burns, greater than 50 percent of the fuel remains (Carter and Foster 2004). Impacts to soils from prescribed burning due to erosion have been shown to be negligible (Jorgensen and Wells 1986, Van Lear and Waldrop 1989). Following a prescribed burn, vegetation would respond fairly quickly to provide erosion protection through strong root system and ground cover. The rate of regrowth depends on when the burn is conducted and weather-related factors. Past evidence from previous burns indicates that vegetation starts to regrow within five days after a burn (Brame 2014 personal communication).

Under all alternatives, prescribed fires would continue to have no long-term impact on soils because although the activity would result in a loss of carbon, prescribed burns would lower the risk of a greater loss of carbon due to a catastrophic fire event such as a wildfire (Jandl et al. 2007). Fire can release nitrogen and other nutrients from the litter and soil (Carter and Foster 2004). Organic carbon accumulation in the soil can decrease because one source of inputs (litter) is released to the atmosphere; however, a prescribed burn would result in a short-term increase in the available nitrogen in the soil that herbaceous plants would positively respond to with a flush of growth. Over time our management, which would put an emphasis on restoring ecological processes, would seek to achieve this equilibrium.

Maintenance activities associated with existing infrastructure and facilities, including mowing and the construction of approved planned RONS and SAMMS projects, would result in negligible, direct, short-term impacts to refuge soils. Similar to forest management activities, maintenance and new construction activities would have the potential to negatively impact soil because land disturbance would occur. We would implement best management practices to protect existing vegetation and prevent soil erosion and contamination, minimizing the potential impacts from these activities.

#### *Public Use and Access*

Hunting opportunities would result in negligible, direct, long-term impacts to soils because hunters would be dispersed through a relatively large portion of

the refuge. Foot and vehicle traffic would have the potential to impact soils through compaction and erosion due to degradation or removal of vegetation. Impacts would be minimized because hunters would not be concentrated in densities or frequency to impact soil.

#### 4.5.2 Soils Impacts of Alternative A

##### **Beneficial Impacts**

Same as the impacts that do not vary among alternatives.

##### **Adverse Impacts**

Same as the impacts that do not vary among alternatives.

#### 4.5.3 Soils Impacts of Alternative B

##### **Beneficial Impacts**

Same as the impacts that do not vary among alternatives.

##### **Adverse Impacts**

###### *Habitat Protection and Management*

Same as the impacts that do not vary among alternatives.

###### *Public Use and Access*

Construction of the trail improvements and the extension of the existing 0.5-mile nature trail to a 3-mile nature trail would result in minor, direct, short-term impacts to soils along the trail corridor, from the land disturbance associated with construction. Maintenance and use of the trail by the public would result in minor, direct, long-term impacts from foot traffic because the trail would be maintained indefinitely.

Increased public use activity, including expanded hunting opportunities, on the refuge would result in negligible, direct, long-term impacts to soils adjacent to designed public use areas such as trails and parking areas. Under alternative B, we would promote and increase the number of visitors to the refuge through enhanced public uses. Foot and vehicle traffic would have the potential to impact soils through compaction and erosion due to degradation or removal of vegetation. We would minimize impacts by installing interpretive signs that require users to stay on the designated paths and trails and explain the reasons why.

#### 4.5.4 Soils Impacts of Alternative C

##### **Beneficial Impacts**

###### *Habitat Protection and Management*

Converting the pine-dominated forest to a transitional dry hardwood forest would result in minor, direct, long-term impacts to soils. After the forest conversion activities are complete, management activities in the transitional dry hardwood forest would cease. Ceasing management activities would prevent soil disturbance. Prescribed burning in clear cut areas should have less impact on soil respiration response than areas that are selectively thinned, possibly due to higher intensity fires if there is a higher fuel load (Concilio et al. 2005).

###### *Public Use and Access*

Same as the impacts that do not vary among alternatives.

### **Adverse Impacts**

#### *Habitat Protection and Management*

Forest management activities in the conversion of the pine-dominated forest to the transitional dry hardwood forest would result in minor, direct, short-term impacts to soils because for specific burn units the forest thinning activities would require more equipment and land disturbance to achieve the desired condition. In young, dense stands we would utilize clear cutting to remove pine trees. In other stands, we would utilize selective cutting. Clear cutting would be the most equipment intense effort and result in the most land disturbance. Thinning and follow up herbicide application would potentially lead to nutrient losses due decreased microbial activity in the litter (Vitousek and Matson 1985); however, they found that this impact would be minimized by only removing the trunk of the tree while leaving branches, twigs, and associated organic matter to maintain the litter. As discussed previously, we would utilize forest best management practices to minimize impacts to soils.

Forest management activities in the conversion of the pine-dominated forest to the transitional dry hardwood forest would result in minor, direct, short-term impacts to soils because more herbicide applications would be required to suppress pine regeneration, and herbicides may accumulate in the forest litter and soils. We would minimize the impacts to soils from herbicide use by implementing best management practices during application and use only approved herbicides.

#### *Public Use and Access*

Adverse impacts to soils related to public use facility construction and use would be similar to alternative B, even though alternative C includes construction of a 2-mile wildlife drive. Visitor use of the wildlife drive has the potential to result in additional soil compaction impacts if visitors park vehicles along the roadside.

Alternative C includes the greatest potential for increased public use on the refuge that would result in minor, direct, long-term impacts to soils adjacent to the designated public uses areas. The increased number of visitors and public use facilities would result in greater impacts to soil through compaction and degradation of vegetation, potentially leading to greater erosion risk. Similar to alternative B, we would minimize impacts by installing signs reminding users to park and walk only in designated public use areas and explain the reasons why.

## **4.6 Vegetation – Forested Habitats**

The forested habitats of the refuge provide diverse habitat components to support breeding birds and other wildlife. We evaluated the beneficial and adverse impacts of the management actions under the three alternatives on forest habitats. We considered the benefits from:

- Conserving forested areas within the refuge’s acquisition boundary.
- Promoting forest succession and improving forest health.
- Providing a hunting program.

We considered the potential for adverse impacts from:

- Conducting forest management activities.
- Applying herbicide to maintain and in some cases transition forested areas.
- Expanding trails and providing other visitor facilities.
- Increased visitation for wildlife observation, photography, environmental education, and interpretation.

#### 4.6.1 Forested Habitat Impacts That Would not Vary by Alternative

##### **Beneficial Impacts**

###### *Habitat Protection and Management*

By continuing to maintain all forested habitats so that they provide roosting and nesting for bald eagles, the forest habitats would continue to have moderate, direct, long-term impacts because managing for bald eagles is good for overall forest integrity. Bald eagles require large, mature trees, which provide seed source for forest regeneration. Large, mature trees also add structure to the forest canopy. Achieving a mature forest takes a long time. By managing for bald eagles, these trees are protected over the long term.

We would continue to minimize management activities in the mature moist hardwood forest and floodplain forest. Within the floodplain forest we would not conduct any thinning, which would help to minimize the opportunity for invasive plant species to become established because soil disturbance and introduction opportunities would be minimized.

###### *Public Use and Access*

None identified.

##### **Adverse Impacts**

###### *Habitat Protection and Management*

Cultural resource protection requirements would result in minor, direct, short- and long-term impacts to refuge vegetation by affecting how long it may take the refuge to achieve its forest management goal of protecting, enhancing, and restoring the ecological integrity of inner coastal plain forest ecosystems of the lower James River to support native wildlife and plant communities and to ensure those ecosystems are resilient in anticipation of climate change. Cultural resources are known to occur throughout the refuge, but our protection of sites in the pine-dominated forest requires us to restrict mechanical thinning and prescribed burning activities. To minimize the potential to adversely affect cultural resources, we would continue to limit physical disturbance near known cultural resource locations and comply with existing standard operating procedures for refuge forest management and prescribed burning activities. Alternative timber management techniques, such as hand labor and herbicide application, would be employed to achieve the desired tree and mid-story vegetation densities.

###### *Public Use and Access*

None identified.

## 4.6.2 Forested Habitat Impacts of Alternative A

### Beneficial Impacts

#### *Habitat Protection and Management*

Thinning and prescribed burning activities in the pine-dominated forest would result in minor, direct, long-term impacts to the overall health of the refuge's pine-dominated forest by reducing the threat of a potential pine beetle infestation. Increasing the distance between individual pine trees limits the spread of the southern pine beetle through the entire stand. Reducing pine density in multiple, adjacent stands reduces the potential for a pine beetle infestation to spread throughout other pine-dominated forests on the refuge and reduces vulnerability to pine beetle infestation from adjacent forests. One study also showed that fire can increase resin flow in pine species which increases resistance to future southern pine beetle infestations (Knebel and Wentworth 2007). Proper silviculture management techniques of thinning and promoting a stand of large, healthy trees should reduce susceptibility to infestations.

Reducing fuel loads and the potential for catastrophic wildfires in the pine-dominated forest would result in moderate, direct, long-term impacts to refuge vegetation by making our pine-dominated forest healthier, more wildfire-resistant. Currently in the pine-dominated forest, surface fuels (such as downed logs and woody material) are present and tree density is relatively high. If a wildfire started, it could quickly climb up the midstory trees and start the canopy on fire, where it would spread and ignite other trees. We would minimize the potential for a severe wildfire through thinning and prescribed burning to reduce surface fuels, increase the distance between the ground and the tree canopy, decrease canopy density, and maintain mature, fire-resistant trees, which have been recommended to make dry forests more resistant to fire (Agee and Skinner 2005). These practices have been shown to reduce wildfire intensity, rate of spread, and predicted tree mortality (Stephens and Moghaddas 2005).

#### *Public Use and Access*

Same as the impacts that do not vary among alternatives.

### Adverse Impacts

#### *Habitat Protection and Management*

Protecting hardwood tree species during thinning and prescribed burning activities in the pine-dominated forest would continue to result in minor, indirect, long-term impacts to the refuge's pine-dominated forest. Remaining hardwoods would continue to compete for resources with the mature pine trees. Under alternative A, we would protect hardwood trees that would produce seedlings that would be in constant competition with pine seedlings. The more tolerant hardwoods (such as various species of oaks and hickories, sweetgum, holly, and dogwood) would gradually increase in numbers and in basal area until they share dominance with each other and with loblolly pine (Baker and Langdon 1990). Competition adversely affects the growth of loblolly pine in varying degrees depending on the site, the amount and size of competing vegetation, and age of the loblolly pine stand. Across the southern region, average loss of volume production in pines resulting from hardwood competition has been estimated at 25 percent in natural stands and 14 percent in plantations (Baker and Langdon 1990).

Limiting the season when prescribed burns would occur to the dormant season would have moderate, direct, short-term impact on the refuge vegetation by allowing higher survival rates for understory vegetation that would compete with young pines. During the dormant season, shrubs store more of their carbohydrates underground, and these carbohydrates enable resprouting when the aboveground portion is killed by fire (Drewa et al. 2002). During the growing season, more of the carbohydrates are allocated aboveground, and are lost with topkill, leaving fewer reserves for resprouting. Prescribed burns are more effective in reducing fuel loads and controlling understory vegetation during the growing season (Knapp et al. 2009).

*Public Use and Access*

Continued public use of the existing 0.5-mile nature trail and canoe/kayak launch, and deer hunting throughout the refuge, would result in negligible, direct, short-term impacts on the refuge's forest vegetation. For the past 10 years, the refuge has averaged approximately 400 visitors annually, most of who are participating in the refuge's deer hunt. As hunters access the walking path, vegetation is temporarily compacted but rebounds quickly.

### 4.6.3 Forested Habitat Impacts of Alternative B

#### **Beneficial Impacts**

*Habitat Protection and Management*

In addition to the benefits discussed in alternative A, reducing the tree density in the pine-dominated forest to 200 trees per acre within the life of the CCP and to between 80 to 100 trees per acre over the next 30 years to achieve a pine savanna density would provide moderate, indirect, long-term impacts because healthier trees and an herbaceous understory would result from management actions. Reducing the tree density would allow more sunlight to reach the forest floor, which would stimulate the growth of the herbaceous understory. Prescribed burning would reduce the thickness of leaf litter, allowing germination and establishment of desirable trees and herbaceous plants (Moorman and Sharpe 2002). Prescribed burning would also control plants that compete with pines, further stimulating pine tree growth. Seasonal timing of prescribed burns, between late winter and late spring, would vary based on burn unit conditions and fuel present. Late spring burns would be more effective in controlling hardwood species and stimulating herbaceous vegetation growth. During thinning and prescribed burning activities, we would implement measures, such as preventing soil compaction or wounds inflicted during thinning operations around mature pine trees and minimizing heat intensity around mature trees during prescribed burns, to protect the health of our desired trees (Kush et al. 2004). Kush et al. (2004) also recommended the importance of considering the amount and types of fuels present in a pine stand undergoing savanna conversion to minimize fire impacts to mature trees and meet habitat objectives.

In addition to the benefits described in alternative A, thinning and prescribed burning activities in the pine-dominated forest would result in minor to moderate, direct, long-term impacts to refuge vegetation with respect to managing invasive species because the desired tree density of the pine savanna forest would more significantly reduce the threat of a disease outbreak or pest infestation. In the current overstocked pine-dominated

forest, a disease outbreak or pine beetle infestation would have the ability to decrease forest stand health. Brown et al. (1987) found that when pine stands were thinned to a basal area of less than 100 square feet per acre, tree vigor increased and, along with the increased distance in tree spacing, forest stands were less susceptible to pine beetle invasion. Reducing the density of trees and increasing the distance between trees to between 80 and 100 trees per acre over the next 30 or more years would further reduce the susceptibility of pine stands to pine beetle infestation.

Monitoring habitat health through the habitat requirements of the priority refuge species for the pine-dominated, mature moist hardwood, and floodplain forests would provide minor, indirect, long-term impacts to refuge vegetation. As needed, we would be able to adjust management activities as needed to promote healthier vegetation. Monitoring habitat conditions that support resident brown-headed nuthatch populations and breeding populations of Chuck-will's-widow would inform us about habitat quality of the pine-dominated forest. Monitoring habitat conditions that support eastern box turtles, wood thrushes, and red-shoulder hawks would inform us about the habitat quality of all vegetation levels in the mature moist hardwood forest. Monitoring habitat conditions that support bald eagles, prothonotary warblers, and spotted salamanders would inform us about the habitat quality of the floodplain forest. We would pro-actively adjust management actions to protect the ecological integrity of these habitats.

*Public Use and Access*

Same as the impacts that do not vary among alternatives.

**Adverse Impacts**

*Habitat Protection and Management*

The conversion of two forested acres to non-forested upland at the weather station would result in negligible, direct, long-term impacts to the pine-dominated forest.

Minor, direct, short-term impacts to small patches of mature moist hardwood forest would result from thinning and prescribed burning activities in adjacent to pine-dominated forest. Although thinning and prescribed burning activities would occur in the pine-dominated habitat, there would be instances where we would anticipate either allowing or being required to allow a treatment to cross over into mature moist hardwood forest for logistical reasons such as access, site preparation, or completeness of a burn. Mature moist hardwood forest is not dependent on a fire frequency for maintenance like the pine savanna, but an infrequent, small-scale burn at the edge with another habitat would likely have been a historic feature of this habitat. Impacts to the vegetation of the mature moist hardwood vegetation from prescribed burning activities would likely be minimized by the wetter soil conditions and reduced susceptibility of fuels found in this habitat.

*Public Use and Access*

Improvement of existing and creation of new refuge infrastructure to support visitor use on the refuge would result in minor, direct, short-term, and negligible, direct, long-term impacts in the pine-dominated, moist hardwood, and floodplain forests. In the short term, minor impacts to forest vegetation would be primarily associated with the use of heavy equipment to remove trees for the construction of 2.5 miles of new trail segments, establishment of

four parking areas, and installation of interpretive signage in the designated public use area. In the long term, impacts on vegetation would decrease as the vegetation adjacent to these areas recovers from the temporary use and presence of equipment. Through site planning and interpretive messaging, we would minimize the potential for impacts to refuge vegetation beyond the designated public use area including parking lots and nature trail.

#### **4.6.4 Forested Habitat Impacts of Alternative C**

##### **Beneficial Impacts**

###### *Habitat Protection and Management*

Thinning and prescribed burning to convert the pine-dominated forest to a transitional dry hardwood forest would result in moderate, direct, short- and long-term impacts to refuge vegetation because a young mix of hardwood species and pine trees would be released from direct competition with the overstocked pine-dominated forest. Loblolly pine has been shown to produce an adequate seed bank to allow for natural regeneration once the canopy trees are removed (Shelton and Cain 2000). Young loblolly seedlings are resistant to disturbance during forest thinning. Removal of a significant portion of the pine trees would also likely lead to an increase in native deciduous vegetation. Augusto et al. (2001) found that 86 percent of the native plant species could be restored from the seed bank in areas where pine plantations were established on historic non-pine forest sites. We would prevent unnecessary damage to refuge vegetation by employing best management practices during thinning activities, such as designating logging decks, clearly defining work areas after considering site conditions, and cleaning vehicles and equipment prior to entering the refuge.

Converting the pine-dominated forest to a transitional dry hardwood forest would provide moderate to major, direct, short-term impacts to refuge vegetation because early successional plant and wildlife species would be abundant following tree removal and the threat of pine beetle infestations would be reduced. The overstocking of pine trees that occurred during the previous ownership has resulted in forest stands with a low plant diversity. Removing a large proportion of the pine trees would allow sunlight to reach the forest floor and early successional plant species to take advantage of available water and nutrient resources. Early successional plant species would add to the overall plant diversity of the refuge because most of the refuge forest habitats are characterized as later successional forest stands. As the transitional dry hardwood forest aged and if disturbance such as prescribed fire or additional tree thinning did not occur, the species composition would change to mid successional and late successional plant species that take advantage of such habitat conditions. Because pine trees would comprise less than 20 percent of the woody vegetation per acre in the transitional dry hardwood forest, the potential of pine beetle infestations would be low.

Converting the pine-dominated forest to a transitional dry hardwood forest would provide minor, indirect, long-term benefits to moist hardwood forest because the conversion would increase the amount of contiguous hardwood forest on the refuge. In relation to plant species, providing contiguous habitat would allow for greater plant species diversity throughout the hardwood forest.

Beneficial impacts related to monitoring habitat health through the habitat requirements of the priority refuge species for the moist hardwood forest and floodplain forest would be the same as under alternative B, even though we would monitor habitat health for a different group of priority refuge species. Monitoring habitat health of the transitional dry hardwood forest through the habitat requirements of breeding black-and-white warblers and ovenbirds would provide minor, indirect, long-term impacts to refuge vegetation. We would adjust management activities as needed to promote healthier vegetation.

*Public Use and Access*

Same as the impacts that do not vary among alternatives.

**Adverse Impacts**

*Habitat Protection and Management*

Converting the pine-dominated forest to transitional dry hardwood forest would result in moderate, direct, long-term impacts to refuge vegetation because removing a large proportion of the pine canopy through mechanical operations to large blocks of forest would provide an opportunity for invasive plant species to become established. We would utilize best management practices during thinning activities to limit ground disturbance and prevent equipment from bringing seeds and plant material to the site that could become established. Even under the best management practices, minimal ground disturbance would be followed by seeding or planting with native species to reduce potential for invasive plant establishment. Additionally, reducing the canopy would provide conditions that would favor the establishment of invasive species. Many of the invasive species present on the refuge or near the refuge are associated with recently disturbed sites (Brame 2013 personal communication). We would anticipate an intense effort by the refuge to control and prevent the establishment of invasive plants in thinning units. To control invasive species, multiple broadcast herbicide applications would be required per year, which would adversely impact native, non-target vegetation until invasive species were under control.

Adverse impacts relating to habitat protection and management of mature moist hardwood forest would be the same as those identified in alternative B.

*Public Use and Access*

Improvement of existing and creation of new refuge infrastructure to support visitor use on the refuge would result in minor, direct, short-term impacts, and negligible, direct, long-term impacts in the transitional dry hardwood, moist hardwood, and floodplain forests. Adverse impacts on forested habitats related to improvement of existing and creation of new infrastructure would be similar to alternative B, except that the pine-dominated forest would be converted to transitional dry hardwood under alternative C.

## **4.7 Vegetation – Non-forested Habitats**

The non-forested habitats of the refuge provide diverse habitat components to support breeding birds and other wildlife. We evaluated the benefits and adverse impacts of the management actions under the three alternatives on non-forest habitats. We considered the benefits from:

- Conserving non-forested areas within the refuge’s acquisition boundary.
- Conducting invasive species management.

We considered the potential for adverse impacts from:

- Promoting forest succession.
- Conducting forest management activities.
- Applying herbicides to maintain and in some cases expand non-forested areas.
- Expanding trails and providing other visitor facilities.
- Increased visitation for wildlife observation, photography, environmental education, and interpretation.

#### 4.7.1 Non-forested Habitat Impacts That Would not Vary by Alternative

##### **Beneficial Impacts**

##### *Habitat Protection and Management*

Aquatic habitats provide a food source for bald eagles, so maintaining these habitats to provide a food source would result in moderate, direct, long-term impacts to water quality. By continuing to maintain the erosional bluff as perching areas for foraging bald eagles, this habitat type would continue to have moderate, direct, long-term impacts from limited vegetation removal and reduced potential for erosion.

Limited active management would provide minor, direct, short- and long-term impacts to freshwater marsh and shrub swamp, aquatic habitats, and erosional bluff because the ecological integrity of each of these habitats is relatively intact. With each management action, there would be the potential that unintended impacts would occur, such as completing a prescribed burn that results in promoting an invasive species or bringing in invasive species on equipment. Invasive species would have the potential to adversely impact the ecological integrity of any habitat. We would continue to conduct informal monitoring of invasive species as a means of early detection. The establishment and spread of invasive species would be one factor that would trigger management actions within a habitat. For example, the establishment of invasive species, such as common reed, would have the potential to degrade the integrity of the freshwater marsh and shrub swamp by altering the existing ecological processes. Common reed has been shown to change the hydrology of wetlands where it becomes established (Blossey 1999) and decrease native plant species diversity and abundance (Meyerson et al. 2000). Each of the other non-forested habitats’ integrity could be threatened by the establishment of invasive species.

Continuing to partner with local, State, and Federal agencies to maintain the vegetated riparian areas along the aquatic habitats would provide minor, direct, long-term benefits because riparian areas act to buffer activities that occur on the land from impacts to aquatic habitats. Riparian areas are important because they filter sediments and nutrients, help to moderate water temperature, supply energy inputs in the form of organic matter and woody material, and help to prevent erosion (Lowrance et al. 1984, Lowrance

et al. 1997). Continuing to work with our partners to ensure that these areas remain vegetated would help to protect them from sedimentation and increased nutrients, which promotes water quality and habitat integrity.

Continuing to implement best management practices for land disturbing and herbicide application activities would provide moderate, indirect, short- and long-term impacts to aquatic habitats because these practices would help to prevent habitat degradation. The impacts from sediment generated from land disturbing activities and transport of chemicals from land to the aquatic environment are discussed in sections 4.4 and 4.6. Implementing best management practices on the land would help to protect aquatic habitats because sedimentation would be reduced and chemicals would not contaminate these habitats.

*Public Use and Access*

None identified.

**Adverse Impacts**

*Habitat Protection and Management*

None identified.

*Public Use and Access*

None identified.

**4.7.2 Non-forested Habitat Impacts of Alternative A**

**Beneficial Impacts**

*Habitat Protection and Management*

Continued coordination with partners to monitor water quality at stations within the vicinity of the refuge used to promote the health of the James River watershed would provide minor, indirect, short- and long-term impacts to aquatic habitats because the information collected would help to inform us on progress being made to protect and improve water quality. Of all the habitats on the refuge, the conditions of aquatic habitats are the ones most influenced by activities and factors that occur outside of the refuge's control. Continued coordination with partners collecting information on water quality would help us understand the trends and limitations to our aquatic habitats and identify opportunities where our actions would help to improve habitat conditions for aquatic species, such as control of aquatic invasive species.

Mowing native and invasive vegetation in the non-forested upland once per year results would result in negligible, direct, short-term impacts.

*Public Use and Access*

Same as the impacts that do not vary among alternatives.

**Adverse Impacts**

*Habitat Protection and Management*

Same as the impacts that do not vary among alternatives.

*Public Use and Access*

Continued public use on the existing 0.5-mile nature trail and canoe/kayak launch would continue to result in negligible, direct, short-term impacts on the refuge's freshwater marsh and shrub swamp, as well as aquatic habitats. For the past 10 years the refuge has averaged approximately 400 visitors

annually. Fewer than 20 percent of those visitors participate in the annual non-hunting refuge- or partner-sponsored events along Powell Creek. As boaters with canoes, kayaks, or non-trailerred hand-launched boats with small motors access the walking path, vegetation is temporarily compacted but rebounds quickly.

### 4.7.3 Non-forested Habitat Impacts of Alternative B

#### Beneficial Impacts

##### *Habitat Protection and Management*

Monitoring habitat health through the habitat requirements of the priority refuge species for the freshwater marsh and shrub swamp and erosional bluff would provide minor, indirect, long-term impacts to refuge vegetation. As needed, we would be able to adjust management activities as needed to promote healthier vegetation. Monitoring habitat conditions that support migratory and breeding populations of marsh wrens and least bitterns would inform us about habitat quality of the freshwater marsh and shrub swamp. Monitoring habitat conditions that support bank swallow would inform us about the habitat quality of the erosional bluff. We would pro-actively adjust management actions to protect the ecological integrity of these habitats.

Regular monitoring of shoreline conditions and bank loss within refuge would provide minor, indirect, short-term impacts to erosion bluff habitat within the refuge because observations and data would be used for future planning when determining the site-appropriate shoreline stabilization techniques and planting options. Collecting information on the condition and rates of erosion on the shorelines and stream banks would allow us to understand how severe the problem is, what would be considered background levels, and what techniques would be appropriate given the site conditions.

Beneficial impacts of mowing vegetation in the non-forested upland would be similar to alternative A.

##### *Public Use and Access*

Same as the impacts that do not vary among alternatives.

#### Adverse Impacts

##### *Habitat Protection and Management*

Same as the impacts that do not vary among alternatives.

##### *Public Use and Access*

Improvement of existing and creation of new refuge infrastructure to support on-refuge visitor use would result in minor, direct, short-term impacts, and negligible, direct, long-term impacts in the freshwater marsh and shrub swamp. In the short term, minor impacts to freshwater marsh and shrub swamp vegetation would be primarily associated with the use of heavy equipment to remove trees to construct 2.5 miles of new trail, build a wildlife observation blind that also supports waterfowl hunting, and install interpretive signage in the designated public use area. In the long term, impacts on vegetation would decrease as the vegetation adjacent to these areas recovers from the temporary use and presence of equipment. Through site planning and interpretive messaging, we would minimize the potential for impacts to refuge vegetation beyond the designated public use area, which includes two fishing locations, and wildlife observation blind.

Opening the refuge to fishing at two designated locations along the nature trail and improving the existing canoe/kayak launch on Powell Creek would result in negligible, indirect, short-term impacts to aquatic habitats because the activities would have the potential to disturb SAV beds through human disturbance. We would minimize impacts by monitoring the presence of SAV beds and educating the public on their importance to the refuge and the resources of the James River watershed.

#### **4.7.4 Non-forested Habitat Impacts of Alternative C**

##### **Beneficial Impacts**

###### *Habitat Protection and Management*

Impacts related to monitoring habitat health through the habitat requirements of the priority refuge species for the freshwater marsh and shrub swamp and erosional bluff would be the same as identified under alternative B.

Beneficial impacts on erosional bluff relating to regular monitoring of shoreline conditions and bank loss would be the same as under alternative B.

Clearing new logging decks and planting native grasses would have minor, direct, short- and long-term impacts to non-forested upland habitat because grassland plant abundance and species diversity would increase following establishment. We would create a natural mosaic of small open grasslands within the hardwood forest. Managing for these in the non-forested upland would promote increased plant diversity within the refuge.

Monitoring habitat health of the non-forested upland through the habitat requirements of migratory and breeding northern woodcock and resident bobwhite would provide minor, indirect, long-term impacts to refuge vegetation. As needed, we would be able to adjust management activities as needed to promote healthier vegetation.

###### *Public Use and Access*

Same as the impacts that do not vary among alternatives.

##### **Adverse Impacts**

###### *Habitat Protection and Management*

Same as the impacts that do not vary among alternatives.

###### *Public Use and Access*

Adverse impacts on freshwater marsh and shrub swamp habitat relating to the improvement of existing and creation of new infrastructure to support on-refuge visitor use would be the same as alternative B.

Adverse impacts on aquatic habitats related to opening the refuge to fishing and improving the existing canoe/kayak launch on Powell Creek would be similar to alternative B, although we would designate three locations for fishing under alternative C.

## **4.8 Birds**

We evaluated the management actions we proposed in the alternatives for their potential to benefit bald eagles and other bird species by protecting

them or their potential habitat. The benefits we considered included:

- Protection, enhancement, and restoration of forested and non-forested habitats.
- Reduction in invasive plants.

The potential adverse impacts of the alternatives that we evaluated included impacts from:

- Forest management activities.
- Increased visitation.
- Invasive species control activities.

#### 4.8.1 Bird Impacts That Would not Vary by Alternative

##### **Beneficial Impacts**

##### *Habitat Protection and Management*

We would continue to provide moderate, direct, long-term impacts by maintaining and managing for those habitat qualities that exist on the refuge that directly benefit nesting and wintering bald eagles, including super-canopy trees for nesting and roosting, mature riparian forests with limited to no disturbance, and healthy marsh and aquatic habitats for feeding (USFWS 2007b). Trees that bald eagles nest in are typically older, mature trees. If these types of trees are lost on the refuge, it will take decades to replace them, and the value of the refuge to bald eagles may be reduced. Maintaining and improving forest health is one way to ensure that the refuge maintains the existing number of large trees and provides the potential for tree replacement into the future so that the refuge maintains its value to bald eagles for nesting and roosting.

Research and monitoring with partner organizations provides moderate, direct, long-term impacts. Since 1977, the CCB has conducted Statewide annual surveys of breeding bald eagles. Regionally, this work has been important to document bald eagle abundance and breeding populations. We would continue to work with the CCB to obtain additional information about bald eagles on the refuge and its surroundings (e.g., nest locations) that would continue to benefit refuge management and inform future management plans. The Audubon Society has conducted bird surveys to help get the IBA designation and to initiate the purchase of the Blair's Wharf property. The Audubon Society is currently assisting refuge staff with conducting annual breeding bird counts to monitor effects of our forest management techniques.

We would continue to perform invasive species management to provide moderate, direct, long-term benefits to ground nesting birds, cavity nesters, and songbird species. The establishment of an invasive plant species can inhibit nesting and movement of young for ground nesting birds by out-competing native herbaceous vegetation. Invasive plants can quickly spread, become dominant, and change the characteristics of many habitats. Monocultures of species can reduce food options and availability for resident and migrating songbirds (Miller et al. 2010). Invasive pest species, such the pine beetle, can degrade older, larger trees, which would remove nesting and foraging habitats for canopy nesting species (Rabenold et al. 1998). Under all

alternatives, the refuge would conduct invasive species management through inventories of current populations, documentations of new species introductions and management through chemical, mechanical or prescribed fire methods as funding and resources allow. Outside of direct management of invasive populations, we would use best management practices during other habitat work to reduce the spread or introduction of invasive species.

Under all alternatives, retaining the existing mature moist hardwood and floodplain forest habitats would provide minor to moderate, direct, long-term benefits to ground and cavity nesting birds, as well as songbirds and raptors. This habitat is relatively intact and functions with a high degree of ecological integrity. Wild turkeys utilize the mature moist hardwood forest habitat for feeding on mast crops and invertebrates and nesting (Eaton et al. 1970, Markley 1967). The existing moist hardwood forest and floodplain forest provide large, mature trees (such as beech or oaks) that are utilized by cavity nesting birds, such as woodpeckers, song birds, and wood ducks (Reller 1972, Conner and Adkisson 1976, Hepp and Bellrose 2013). Neotropical migratory birds utilize the moist hardwood and floodplain forests during their annual spring and fall migration periods. The midstory and canopy structure of these habitats meets the requirements of a diversity of species. In particular, these forests are near and over water, an important characteristic that is beneficial to neotropical migratory birds, such as prothonotary warblers that use these areas for nesting (Somershoe and Chandler 2004, Petit 1999). Native raptor species favor mature mixed forests, especially in bottomland hardwoods or riparian areas for hunting and nesting (Dykstra et al. 2008). We would continue to limit disturbance and management activities in this area to benefit these avian species.

Wood ducks use the freshwater marsh shrub swamp habitat for brood rearing (Hepp and Bellrose 2013). Other waterfowl and waterbird species use the marsh habitat for breeding, nesting, foraging, and as a stopover habitat during migration or overwintering (VDGIF 2009). While the refuge has only 82 acres of freshwater marsh and shrub swamp, this habitat is in relatively good ecological condition. We would continue current protection of freshwater marsh and shrub swamp habitat, which would have minor, direct, long-term impacts to waterfowl. Under all alternatives, we would also work to improve aquatic habitat protection through management actions on the refuge and maintaining or increasing partnerships off the refuge. Protecting aquatic habitat would help to improve the SAV community in the aquatic habitats of the refuge. SAV provides a valuable food resource for migrating and overwintering waterfowl (Perry and Uhler 1988, Perry and Deller 1996). Improving aquatic habitats through protection and increased partnerships would have minor, direct, long-term impacts on waterfowl and waterbirds due to improved food resources.

Bank swallows create cavities for nesting in the soft, unconsolidated soils of the refuge's erosional bluff habitat. We currently use best management practices to limit human disturbance to the erosional bluff vegetation and maintain bald eagle roosting trees. Tree protection activities that stabilize the erosional bank would have negligible, indirect, long-term impacts on bank swallows because the best management practices attempt to limit disturbance, but erosion caused by the James River continues to create areas where bare soil is present on nearly vertical slopes.

Raptor species forage in grasslands for rodents, reptiles, and other prey (Preston and Beane 2009). The raptors known to use James River NWR would continue to receive negligible, direct, long-term impacts from being able to forage in the non-forested upland. We would continue to maintain approximately 13 acres of non-forested upland under alternative A up to a maximum of 57 acres under alternative C. These non-forested upland areas would be associated with either the weather station, logging decks used for forest management activities, or refuge facilities and would be relatively small in size when compared to the other habitats of the refuge.

*Public Use and Access*

We would continue to provide direct, moderate, long-term impacts to bald eagle nesting areas by managing visitor access in accordance with BGEPA requirements. Within 330 feet of known nesting sites, we would continue to limit access between December 15 and July 15 (VDGIF and USFWS 2000) to minimize disturbance during incubation and other nesting activities that could reduce recruitment rates. As evidenced by the remarkable recovery of bald eagles nationally, maintaining the 330-foot buffer around known nest sites where disturbance is minimized has been a valuable tool.

**Adverse Impacts**

*Habitat Protection and Management*

None identified.

*Public Use and Access*

Lead-based ammunition used for deer hunting has the potential to cause lead poisoning in bald eagles or other birds of prey. Unrecovered animals and offal (gut) piles from deer can contain lead fragments that, if ingested, could expose birds to lead. We do not collect information from hunters that allow us to estimate the rate or number of unrecovered deer carcasses produced every year; however, over the past 5 years, the muzzleloader and shotgun hunt program has averaged 206 hunters per year with an annual average total harvest of just over 32 deer per year (Brame 2013 personal communication). Areas within the refuge designated for the deer hunt are in the heavily wooded areas of the pine-dominated forest, moist hardwood forest, and floodplain forest away from existing bald eagles nests. We believe that unrecovered animals containing lead shot from the shotgun and muzzleloader hunts would have negligible impacts to bald eagles based on the small number of carcasses potentially produced each year. No eagles or non-target animals have been found to have died from lead poisoning on the refuge, though the potential exists because lead shot is used for deer hunting (Brame 2014 personal communication). We encourage hunters to use lead-free shot on the refuge.

**4.8.2 Bird Impacts of Alternative A**

**Beneficial Impacts**

*Habitat Protection and Management*

Changing the pine-dominated forest structure through pine thinning and burning activities would continue to have minor to moderate, direct, long-term impacts to bald eagles, other raptors, and ground and cavity nesting species. Bald eagles would benefit from increasing tree spacing to achieve larger, super canopy trees, which bald eagles use for nesting and roosting. In addition to creation of nest trees, opening of the understory would increase

hunting opportunities for raptor species. Ground nesting birds would benefit from increased nesting opportunities in preferred herbaceous vegetation for nest concealment and foraging. Current thinning activities in the pine-dominated forest are reducing the tree density from an overstocked density of an average of 1,000 trees per acre to a target of 400 trees per acre over the life of this CCP. Removing these trees opens up the canopy and midstory and allows sunlight to reach the forest floor, which stimulates herbaceous understory vegetation growth. Thinning and prescribed burning of the pine-dominated forest habitat management would not directly create additional cavity nesting trees; however, management would still provide beneficial impacts by maintaining existing snags, as well as protecting and improving forest health, to make sure there are large trees available in the future. These management practices would benefit woodpecker and songbird species that utilize snags and mature trees for nesting.

Protecting mast-producing hardwood trees, such as oaks, in the pine-dominated forest would have minor, direct, long-term benefits for wild turkey and other species that can utilize the large nut as valuable food resource, and resident and migrating song birds, which use these species for cover and nesting. When planning management activities, we would protect mast producing trees from thinning by not marking them for harvest. During prescribed burns, we would use fire and fuel management techniques to prevent fire intensity that would result in mast-producing tree mortality, reducing this food resource and nesting habitat.

#### *Public Use and Access*

Same as the impacts that do not vary among alternatives.

#### **Adverse Impacts**

##### *Habitat Protection and Management*

Disturbance to nesting or foraging bald eagles from prescribed fire activity in the pine-dominated forest would potentially result in nest abandonment, increased stress, or reduced energy reserves to provide for nestlings. However, every year refuge staff develops and implements a prescribed burn plan for the areas proposed for management action. Burn objectives, fuel, and smoke management are all considered prior to conducting a prescribed burn. Because bald eagle nests on the refuge are currently all in the moist hardwood and floodplain forest, any prescribed burn activities conducted according to the prescribed fire plan would have negligible, indirect, short-term impacts to bald eagles. We would evaluate the potential for smoke impacts on bald eagle nests from all burn operations done within the nesting period. Refuge burns would occur across 1 to 2 days, and fewer than three burns would continue be conducted each year. Activities that are short in duration and few in number tend to be the least impactful to bald eagles (Grubb and King 1991).

Forest thinning activities would potentially have moderate, direct, short-term impacts on nesting and foraging bald eagles because it is a prolonged activity (occurring over several weeks) and involves human and vehicle activity that produces noise. We currently implement the National Bald Eagle Management Guidelines recommendation of a minimum of a 330-foot buffer from known nest sites when conducting forest management activities (USFWS 2007c). Once the desired tree density is achieved, thinning operations will no longer be used and this habitat will be maintained with

prescribed fire.

Thinning and prescribed burning would potentially have minor, direct, short-term impacts on ground or cavity nesting or songbird species, through disturbance during the nesting season that would destroy nests or causes abandonment. Operation of thinning equipment would potentially destroy nests or cause noise disturbance. To minimize and ideally avoid such impacts, we currently schedule and conduct thinning activities during the winter months, outside of the ground nesting season. Prescribed burning occurs in the late winter to early spring season; the burn plan identifies April 15 as the last date that a prescribed burn can occur (USFWS 2013b). This mid-April date is intended to minimize adverse impacts to ground nesting birds. While several different species, such as wild turkey, may have already started nesting prior to April 15, we believe that operations are avoiding the majority of the nesting season. The impact would be further minimized because there is a low probability that the same burn unit would be burned consecutive years during the nesting season.

Natural tree loss due to erosion, wind storms, or disease along the erosional bank would have a negligible, direct, long-term impact to cavity nesting birds because the erosional bank habitat represents a relatively small portion of the trees within the refuge available for nesting. Tree loss, especially when due to erosion or wind storms, sometimes results in a tree fall where the root wad exposes bare soil, which would potentially lead to additional tree loss through erosion and loss of habitat for cavity nesting birds. To minimize impacts of natural tree loss in the erosional bluff habitat, we would continue to limit the potential for disturbance around fallen trees by preventing further erosion from occurring, which would cause other trees to fall over.

#### *Public Use and Access*

Bald eagles, other raptors, ground nesting birds, and breeding and migratory songbirds use the forested habitat of the refuge for nesting, roosting, and foraging. Public access to trails, hunts, and education programs on the refuge would result in negligible, indirect, short-term impacts to nesting, foraging, or breeding birds. Pedestrian activity has been shown to be the most disturbing activity to nesting and foraging bald eagles (Grubb and King 1991). Existing trails and public access points are located in discrete locations, and proposed trails would be located in similar places. Individuals may temporarily flush from their nests or perching areas; however, they would return after the visitor exited the area. Neotropical migratory birds use the forested habitat of the refuge in the spring and fall seasons as they move from their summer breeding ranges to their overwintering locations. They use the refuge as stopover habitat to rest and forage before continuing on their migration. High levels of disruption could reduce migration survival due to lack of food reserves. This impact is mitigated by the limited number of hunt days and the permit process, which requires prior approval to access refuge property and trails. The current deer hunt program would have no impacts to nesting bald eagles because the hunt occurs outside of the bald eagle nesting season. The deer hunt program would have negligible, indirect, short-term impacts on other bird species due to the limited days and season. Wildlife observation, photography, environmental education, and interpretation are activities that have the potential to occur year-round on the refuge and would have a negligible, short-term, indirect impact on nesting,

roosting, and foraging bald eagles, raptors, and songbirds. Participation in the refuge's limited public use opportunities would continue to require permits, which restrict duration, location, and number of users.

Waterfowl and marsh birds utilize the freshwater marsh and shrub swamp, floodplain forest, and aquatic habitats of the refuge for nesting, foraging, and resting. Refuge visitors could disturb waterfowl and marsh birds utilizing these habitats; however, we believe no impacts would be associated with public uses along the waterways from canoe and kayak use and along the trails because these accessible areas are relatively small and have few visitors. Only one refuge canoe and kayak access point is along Powell Creek, approximately 2.5 miles from its connection with the James River. Under alternative A, the only hiking trail open to the public is a 0.5-mile trail located along Powell Creek at the southwestern portion of the refuge. With an average of 400 visitors annually and the requirement for permits to access the refuge, the potential for human disturbance would be relatively low and would have no impact on waterfowl or marsh birds.

#### 4.8.3 Bird Impacts of Alternative B

##### **Beneficial Impacts**

###### *Habitat Protection and Management*

Under alternative B, we would increase the intensity and frequency of pine thinning and prescribed burn treatments to convert to a pine savanna habitat. We would reduce tree density down to 200 trees per acre within the life of the CCP and to 80 to 100 trees per acre over approximately the next 30 years. We would also remove most hardwood species from the stand. This change in forest structure would have moderate, direct, long-term impacts on bald eagles, other raptors, and other ground and cavity nesting birds. This alternative would have many of the same benefits to these species that are discussed in alternative A, plus a well-developed ground layer and open to sparse understory layer with large pine trees. In a pine forest that received similar treatments as proposed under alternative B, bird species richness, bird abundance, and species diversity increased over forest stands that did not receive treatment (Conner et al. 2002). Large pine trees are important because bald eagles prefer them over hardwood species for nesting (Watts 2013 personal communication). Other raptors would also use mature trees for nesting and roosting, and they would benefit from the open understory for hunting prey.

Increasing the amount and diversity of herbaceous vegetation through thinning and prescribed fire would have moderate, direct, short- and long-term impacts on foraging and nesting of ground nesting birds. Chuck-will's-widow numbers have increased over the last few years in areas where thinning and burning operations are being conducted. Wild turkey hens benefit from improved brooding, pre-incubation, and nesting habitat (Bowman et al. 1999). Northern bobwhite benefit from increased herbaceous vegetation, which provides increased seed and insect abundance for foraging (Van Lear et al. 2005) and provides enhanced brooding and nesting (Bowman et al. 1999). In the year following a prescribed burn, understory savanna plants have approximately three times higher seed energy availability (Johnson et al. 2011). Brown-headed nuthatches almost exclusively forage on mature pine trees, focusing on insects in the spring/summer months and pine seeds during winter (Slater et al. 2013). Nuthatches would benefit from

increased stand age and fire management practices because of the increase in dead standing trees for cavity nests (Wilson and Watts 1999, Wilson and Watts 2000). Thinning and prescribed burning in the frequency and intensity required to provide habitat conditions for brown-headed nuthatches would also provide habitat for other forest birds, including cavity nesting birds.

Increasing our efforts to monitor the erosion activity and the breeding bank swallow population in the erosional bluff habitat on the refuge would have negligible to minor, direct, long-term impacts. Data collected would help to identify if current and proposed best management practices are working and if additional measures are required. Active management options are limited because bank swallows need eroding banks for nesting.

The creation and revegetation of logging decks to native grass species would provide minor impacts for Chuck-will's-widow, wild turkey, and northern bobwhite because the logging decks would be small forest openings that could be used for foraging (Stoddard 1931, Markley 1967, Straight and Cooper 2012).

#### *Public Use and Access*

Our increased and improved environmental education and interpretation of the refuge's birds and their habitat requirements would provide negligible, direct, long-term impacts by helping to increase public understanding of and appreciation for bald eagles, as well as waterfowl and waterbirds. Providing up to two refuge-sponsored boat trips for approximately 60 people annually to observe bald eagles perching, foraging, and nesting on the refuge would also offer opportunities to observe and learn more about waterfowl and waterbirds in the vicinity.

University research partnerships and education programs would provide minor, direct, long-term impacts by helping to increase knowledge about and awareness of different bird groups using the refuge, including ground nesting birds, cavity nesting birds, raptors, neotropical migratory birds, waterfowl, marsh birds, and bald eagles.

#### **Adverse Impacts**

##### *Habitat Protection and Management*

Although impacts to bald eagles resulting from our pine-dominated forest management activities would be the same as under alternative A, thinning and prescribed burning would have greater impact on other birds. A minor to moderate, short-term impact on ground or cavity nesting or songbird species would result from increased disturbance during the nesting season that would destroy nests or cause abandonment. Impacts would increase in alternative B because prescribed burning would not cease on April 15 but would continue as weather, soils, and resources dictate. Prescribed burns during the growing season (late spring through summer) are shown to increase the knock back of hardwood species and increase seeding and growth response in herbaceous vegetation (Knapp et al. 2009).

Neotropical migratory birds would be impacted by removal of hardwoods. These species utilize the midstory and canopy for stop-over cover and to forage during their spring and fall migrations. This reduced midstory structure would result in moderate, indirect, long-term impacts to neotropical migratory birds because the habitat that they utilize during migration would

be reduced. Conner et al. (2002) observed a negative response for several neotropical bird species under a forest management regime similar to that proposed under alternative B, due to the reduction in the hardwood component in the canopy and midstory. However, the authors noted that impacts to neotropical migratory birds that are important conservation priorities may be less than those to common, ubiquitous species that are more year-round residents, such as northern cardinal and blue jays. The latter species had the greatest declines in abundance following treatments that involved hardwood removal. Protection of our moist hardwood and floodplain forest (which are more preferred habitat for neotropical migratory birds) would still provide stopover habitat for these species.

#### *Public Use and Access*

Under alternative B, the refuge would increase the number of deer hunt days and open the refuge to fall turkey hunting, as well as offer a 1-day spring youth turkey hunt and a limited youth waterfowl hunt. As discussed in chapter 3, we would anticipate conducting additional NEPA analysis prior to expanding the existing deer hunt and offering new hunting opportunities, which would provide a more detailed analysis of the potential impact of these new opportunities on refuge wildlife, including bald eagles. To inform our decision in this CCP, we have considered the range of reasonable impacts using the existing available information. Because the annual deer and fall turkey hunts would be offered in October and November, we believe there would be no new impacts on nesting bald eagles. The spring turkey hunt would occur between April and May, which falls within the period when bald eagles and other avian species are nesting or rearing their young (USFWS 2007c). We believe the spring turkey hunt, which would add up to 80 hunter use days on the refuge, would result in negligible, indirect, short-term impacts to bald eagles and other nesting species. We would limit the areas designated for spring turkey hunting to locations away from known eagle nests. Offering one day of youth waterfowl hunt would have a negligible, direct, short-term impact to waterfowl because the season would be limited to 10 days during the State season and at least one youth hunter per licensed adult companion at one location within the refuge.

The potential for adverse impacts to birds resulting from expansion of the deer hunting program and opening the refuge to turkey hunting would be negligible, indirect, and long-term. As described in bird impacts that would not vary by alternative, unrecovered animals and offal piles from deer could expose birds to lead. Under this alternative, we would encourage hunters to use lead-free shot for hunting on the refuge through our hunting opportunity announcements, environmental education programs, and interpretive materials.

Under alternative B, we would increase public use opportunities by expanding the existing 0.5 mile nature trail to a 3-mile nature trail, constructing a wildlife observation platform and a fishing platform, and improving the existing canoe/kayak launch. To expand the trail and install a wildlife observation platform and fishing platform, noise would be generated by construction equipment and workers. As discussed under alternative A, noise can represent a potential disturbance to nesting and foraging birds. We believe constructing a 3-mile nature trail, a wildlife observation platform, and fishing platform would have minor, indirect, short-term impacts to nesting

bald eagles, raptors, ground and cavity nesters, and songbirds. Best management practices, the short duration, and limited area of the construction should limit impacts on nesting species.

Allowing public use from sunrise to sunset throughout the year in the refuge's designated public use area would impact birds. By providing and promoting increased public use opportunities, we would anticipate the number of visitors to the refuge to increase. As previously discussed in other impacts, bald eagles and other bird species are sensitive to human activity. In particular, pedestrian activity was documented to be the most disturbing to bald eagles (Grubb and King 1991). We would minimize the amount of disturbance to bald eagles by locating the facilities in a portion of the refuge that eagles use less frequently, such as away from known nesting sites and heavily used foraging areas.

The presence of trails has been found to change a local bird community. Miller et al. (1998) found that bird species considered to be generalists were more common near trails than bird species considered to be specialists, and nest predation was greater near trails. We would minimize impacts to these bird groups by requiring visitors to stay on the trail at all times (Miller et al. 2001). We believe that this would result in minor, direct, long-term impacts to bald eagles, other raptors, cavity and ground nesters, and songbirds (including migratory birds). The visitor threshold that results in a decrease in bird densities varies by species; it has been found to be between approximately 3 to 15 visitors per acre (van der Zande and Vos 1984). We anticipate that visitor densities on the 3-mile nature trail would be on the lower end of this range.

Although the existing canoe/kayak launch site is located away from known bald eagle nesting areas, increased boat traffic would result in minor, direct, short-term disturbance of waterfowl and waterbirds. The number of boats using the refuge launch would continue to be limited by parking access.

With an increase in users also comes an increase in vehicular traffic. We believe increased vehicular traffic would have minor, direct, short- and long-term impacts to bird species that would be observed on or along the State roads within the refuge. We would mitigate possible conflicts through interpretative materials, such as making brochures available and utilizing kiosks to educate refuge users on bald eagle use along the roadways. We would also post signs along the roadway that would encourage drivers to use caution and provide an educational message, such as "Give Wildlife a Break."

As part of the expanded public use opportunities under alternative B, the refuge would organize up to two boat trips that would tour along the James River to observe bald eagles. McGarigal et al. (1991) identified boating as an activity that can adversely impact bald eagles in heavily used foraging areas. We believe the two boat tours would have no impacts on bald eagles because the boat would be loaded with visitors and launched from a site outside of the refuge. When approaching eagles, we would instruct visitors to remain relatively quiet to maximize their chance of observing nesting, perching, or foraging eagles.

Opening the refuge to fishing at two designated locations along Powell Creek would result in negligible to minor, indirect, long-term impacts to bald eagles,

songbirds, waterfowl, and waterbirds in two ways. It is a common practice for anglers to cut the line when fish become deep hooked. These fish could be later eaten by raptors, waterfowl, or waterbirds, and the lead tackle could be ingested by these birds, leading to lead poisoning. Recent work has investigated the impact of lead tackle on waterfowl and marsh birds (Schummer et al. 2011, Franson et al. 2003); however, less is known about the direct impacts on bald eagles. We believe occurrences of abandoned carcasses or live fish containing lead tackle would be rare because our designated fishing locations are limited in number and size. We would encourage the use of lead-free tackle in our environmental education programs and interpretive materials.

#### **4.8.4 Bird Impacts of Alternative C**

##### **Beneficial Impacts**

###### *Habitat Protection and Management*

Transitioning the pine-dominated forest to a dry hardwood forest would have minor to moderate, direct, long-term impacts to raptors, ground and cavity nesters, resident songbirds, and neotropical migratory species because of the adjustment of the foraging and nesting habitat conditions that would result from the forest conversion process. Raptors would more easily be able to forage and hunt in the open canopy during the first 5 years following thinning. As hardwoods started to regenerate, the habitat would develop a dense, thick shrub layer that would make hunting more difficult during the next 20 years. Once the hardwood forest was mature, raptor species would enjoy a more open understory with mature canopy trees for perching and nesting. Ground nesting species that prefer open canopy, like bobwhite quail, would increase after thinning until dense successional shrubs took over open areas. Woodcock species in turn would use the stand during dense hardwood regeneration. The rotation of treatment units would also provide continuous habitat for species that use stands at a particular stage. Cavity nesting species would initially have limited to no nesting habitat during the first 30 years of the conversion process until species matured into suitable nest trees or snags. Resident songbird and migratory populations would shift during the conversion process from early successional species to mature species. Some mature hardwood species like black-and-white warblers or ovenbirds have been documented using clear cut areas for raising broods, so clear cut areas may be used by species nesting in neighboring moist hardwood forests.

Expanding logging deck size and converting these areas non-forested upland would have minor, direct, long-term impact to ground nesting birds because we would be increasing the acreage and improving the quality of this type of habitat. The impact to ground nesting birds would be limited because the individual unit size would not provide adequate space for breeding habitat for many ground nesting birds. The amount of native grasslands in the vicinity around the refuge is limited, which would further limit the overall impact to ground nesting birds. Many grassland bird species, like the grasshopper sparrow, are sensitive to size of grassland patches (Vickery et al. 1994) and also respond to the amount of grassland in the overall landscape (Horn and Koford 2004). Northern bobwhite and resident American woodcock would benefit from having the additional acreage of grassland habitat adjacent to the shrubland that would develop during the early stages of the transitional dry hardwood forest (Brennan 1991, USDA 2010).

Beneficial impacts on bank swallow populations related to increased monitoring the erosional bluff habitat would be the same as alternative B.

#### *Public Use and Access*

Beneficial impacts to birds due to increased and improved environmental education and interpretation would be the same as alternative B, even though alternative C has two more boat trips than B.

University research partnerships and education programs would provide minor, direct, long-term impacts by helping to increase knowledge about and awareness of different bird groups using the refuge, including ground nesting birds, raptors, songbirds, waterfowl, marsh birds, and bald eagles.

#### **Adverse Impacts**

##### *Habitat Protection and Management*

To achieve the habitat conversion from pine-dominated to transitional hardwood habitat under alternative C, we would increase the level of forest habitat management activities over those already occurring under alternative A. However, due to guidelines set in our prescribed burn plans and management practices for thinning operations, impacts on nesting bald eagles would not differ largely from alternative A or B. The only difference is that only one or two rounds of prescribed burning at around 15 years of age would occur in alternative C.

Prescribed burning would have negligible, direct, short-term impacts to other raptors, ground and cavity nesters, and songbird species because low intensity burns would only occur once or twice to achieve desired results.

Forest management activities to convert the pine-dominated forest to a transitional dry hardwood forest, which could range from clear cutting to selective thinning, would result in minor to moderate, direct and indirect, short-term impacts to bald eagles, other raptors, ground and cavity nesters, and songbirds because the associated noise and emissions from equipment operation would potentially disturb them from nests and roosting trees. Under alternative C, we would remove a larger volume of trees than in the other alternatives, which would require additional equipment on the ground for longer periods of time. Though timing of thinning operations will primarily be determined by soil conditions, we would mitigate impact to nesting birds by limiting thinning activity in the spring if possible. Each unit would be thinned approximately two to three times, with fewer trees removed each time. The impacts to bird species would be reduced to negligible over time because thinning activities would decrease as the target tree densities are achieved. Previous studies have recommended a buffer distance for noise-generating activities of greater than 3,000 feet from bald eagle nests (Grubb and King 1991); however, we currently implement the recommendations from the National Bald Eagle Management guidelines of a buffer of 330 feet away from known nest sites (USFWS 2007). In addition to noise impacts, thinning of pines may remove suitable nesting or roosting trees for other raptor or cavity nesting species. Mechanical removal of trees may disturb or destroy ground nests. This impact would be limited because mechanical thinning operations should only occur once per unit and then all other thinning would need to be done by hand. Resident and migratory songbirds would be impacted by removal of shrub layer for nesting and cover or by the removal of pines for some species that prefer pine habitat like nuthatches or pine

warblers (Slater et al. 2013, Rodewald et al. 2013). Over time after shrub and midstory levels would recover for those nesting or migratory species that depend on them.

*Public Use and Access*

Deer hunting impacts on birds would be the same as alternative B, even though there would be more hunting days under alternative C. Because the annual deer and fall turkey hunts would be offered in October and November, we believe there would be no new impacts on nesting bald eagles. Additional NEPA review and analysis is required to fully characterize the impacts of our proposal to open the refuge for these new hunts. The spring turkey hunt would occur between April and May, which falls within the period when bald eagles and other avian species are nesting or rearing their young (USFWS 2007c). We believe the spring turkey hunt, which would add up to 260 hunter use days on the refuge, would result in negligible to minor, indirect, short-term impacts to bald eagles and other nesting species. We would limit the areas designated for spring turkey hunting to locations away from known eagle nests. Offering one day of youth waterfowl hunting would have the same impacts on birds as alternative B.

The potential for birds to ingest lead resulting from expansion of the deer hunt and opening the refuge to turkey hunting would be the same as detailed under alternative B.

Impacts to bald eagles, other raptors, ground and cavity nesters and songbirds from increased public use opportunities by expanding the existing 0.5-mile nature trail to a 3-mile nature trail, constructing a wildlife observation platform and a fishing platform, and improving the existing canoe/kayak launch would have the same level of impacts as those discussed under alternative B.

Use of the 2-mile wildlife drive by refuge visitors would have minor, direct and indirect, long-term impacts to bald eagles, other raptors, resident and migratory songbirds. The drive would be located outside of current bald eagle nest areas to reduce the noise impact. Increased vehicle traffic could disrupt nesting or foraging birds or result in injury or mortality of individuals by collision. We would mitigate possible conflicts through interpretative materials such as making brochures available and utilizing kiosks to educate refuge users on bald eagle or other species use along the roadways. We would also posts signs along the roadway that would encourage drivers to use caution and provide an educational message such as “Give wildlife a break.” Sensitive species would likely avoid the area for nesting and foraging. Other ground nesting birds, such as wild turkey, would likely continue to forage or put on mating displays in habitats adjacent to the wildlife drive.

As part of the expanded public use opportunities under alternative C, the refuge would organize or sponsor up to four boat trips that toured along the James River to observe bald eagles. We believe four boat trips would have no impacts, as discussed in alternative B.

Opening the refuge to fishing would have the same impacts to bald eagles and other bird species as discussed in alternative B, even though we would designate three fishing locations under alternative C.

## 4.9 Fisheries

We compared the management actions in the alternatives based on their potential to benefit or adversely affect the refuge's fishery, including actions to help maintain and improve the water quality of the James River, the refuge wetlands, and the watershed. We evaluated the actions that would benefit the fishery by reducing sedimentation and erosion, protecting or restoring riverine functions influenced by vegetation and hydrology, and by maintaining or improving water quality. These actions include:

- Implementing best management practices to reduce sediment load and deposition.
- Maintaining vegetated riparian areas and natural habitats.
- Improving water quality monitoring for early problem identification.
- Coordinating with Federal and State partners to influence water quality in the watershed and protect fisheries and aquatic resources.
- Developing and implementing an IMP.

We compared the impacts of these refuge management actions with the potential to cause adverse impacts on the fishery, particularly by altering refuge hydrology or degrading water quality. The actions we evaluated include:

- Applying herbicides to manage invasive species.
- Conducting forest management activities.
- Constructing and maintaining trails and facilities.

### 4.9.1 Fisheries Impacts That Would not Vary by Alternative

#### **Beneficial Impacts**

##### *Habitat Protection and Management*

Protection of the mature moist hardwood forest, floodplain forest, and freshwater marsh and shrub swamp would provide moderate, indirect, long-term impacts to fisheries because preserving the quality of these habitats would reduce impacts on water quality. These habitats filter nutrients and sediments from stormwater that enters nearby surface waters, including the James River, Flowerdew Hundred Creek, and Powell Creek (Klapproth and Johnson 2009). Under all alternatives, we would continue to retain these habitats in a high quality to maintain the vegetation and ecological integrity.

Continuing partnerships with the state to monitor or improve aquatic habitat would result in minor, indirect, long-term impacts to fisheries because information collected during monitoring would allow us to understand the current condition of the James River and its tributaries within the refuge.

##### *Public Use and Access*

None identified.

### **Adverse Impacts**

#### *Habitat Protection and Management*

If misused or spilled, herbicides to control invasive plant species could result in negligible, direct and indirect, short-term impacts to fisheries. Under all alternatives we would minimize impacts by implementing the best management practices for herbicide application, including safe handling and storage practices, using the minimal effective dosage, utilizing application methods that minimize non-target impacts, timing applications to coincidence during the optimal growth stage, and adhering to label requirements.

Ground disturbing activities (such as thinning, prescribed burning, and construction) would result in negligible, indirect, short- and long-term impacts to fisheries if loose soils enter nearby waterways. Sedimentation is considered the one of the main contributors to decreased fish habitat in the Chesapeake Bay (National Fish Habitat Board 2010). Sediment increases turbidity and decreases water clarity, which can decrease the abundance of SAV beds (Orth and Moore 1984, Orth et al. 2010a, Orth et al. 2010b). Sediment can also cover important substrates such as stone and cobble used by many fish species for spawning beds (Wood and Armitage 1997). Utilizing best management practices have been shown to decrease sedimentation into the James River (VDEQ 2005). Under all alternatives, we would minimize impacts through implementing best management practices during ground-disturbing activities.

#### *Public Use and Access*

None identified.

## **4.9.2 Fisheries Impacts of Alternative A**

### **Beneficial Impacts**

Same as the impacts that do not vary among alternatives.

### **Adverse Impacts**

Same as the impacts that do not vary among alternatives.

## **4.9.3 Fisheries Impacts of Alternative B**

### **Beneficial Impacts**

#### *Habitat Protection and Management*

Same as the impacts that do not vary among alternatives.

#### *Public Use and Access*

Opening the refuge to fishing at two designated locations along Powell Creek would result in minor, indirect, long-term impacts by helping to increase public understanding of and appreciation for our fisheries resources on the refuge and in the James River watershed. Educational messages would be provided at kiosks and in conjunction with the state to visitors of designated fishing locations. We would encourage the use of non-lead tackle in our environmental education programs and interpretive materials.

### **Adverse Impacts**

#### *Habitat Protection and Management*

Same as the impacts that do not vary among alternatives.

#### *Public Use and Access*

Opening the refuge to fishing and allowing this use throughout the year from

sunrise to sunset without a refuge-issued permit would increase public access to waterway and may result in negligible, indirect, short-term impacts on fisheries. The potential for contamination or increased erosion at these sites would be limited by establishing only two locations for fishing within the designated public use area; allowing only non-trailerred, hand-launched boats with small electric motors; and providing limited parking to support up to 1,460 anglers annually.

#### 4.9.4 Fisheries Impacts of Alternative C

##### **Beneficial Impacts**

Same as the impacts detailed under alternative B.

##### **Adverse Impacts**

Same as the impacts detailed under alternative B.

#### 4.10 Mammals

We compared the management actions in the alternatives based on their potential to benefit or adversely affect the refuge's mammals. The benefits we considered included:

- Protection and restoration of native habitats.
- Reduction in invasive plants.

The potential adverse impacts of the alternatives that we evaluated included impacts from:

- Forest management activities.
- Invasive species control activities.
- Increased visitation.

##### 4.10.1 Mammal Impacts That Would not Vary by Alternative

###### **Beneficial Impacts**

###### *Habitat Protection and Management*

Continuing to protect the mature moist hardwood forest and floodplain forest would have moderate, direct, long-term impacts on mammals because their habitat and food resources would be plentiful on the refuge throughout the year. As discussed in chapters 2 and 3, the moist hardwood forest and floodplain forest habitats of the refuge have an ecological integrity that is relatively intact. These habitats would continue to provide habitat for species such as bats that require large trees near water for roosting, as well as for foxes or gray squirrels, which feed on acorns and other fruits produced by the large, hard mast trees of the moist hardwood trees.

Pest and invasive species control would continue to have negligible to minor, indirect, long-term impacts on mammals because this activity protects existing habitat and food resources. Invasive plant species have the potential to change habitat conditions by altering plant community composition and changing habitat structure (Miller et al. 2010). As discussed in chapter 2 and 3, Japanese privet, Japanese stiltgrass, and tree-of-heaven are the most abundant invasive species found in the mature moist hardwood forest. If invasive wildlife species such as feral hogs were to become established on the

refuge, they would degrade habitat quality and compete for food resources with native mammals (Engeman et al. 2007). While we would work to control invasive species under all the alternatives, the intensity of control efforts would be based upon resources available to the refuge.

#### *Public Use and Access*

Conducting public deer hunts would result in minor, indirect, long-term impacts by building the public's connection to the deer populations and their habitats. The increase in knowledge and appreciation for the deer population also increases their investment in maintaining a healthy herd.

Actively monitoring the refuge deer population in conjunction with VDGIF would continue to have minor, direct, long-term impacts because we would collect information that would help us monitor the deer herd health. A healthy deer herd is resistant to disease, provides sustainable opportunities for harvest through hunting, and is an indicator of healthy forest habitat. Monitoring the deer population would complement our vegetation monitoring to support management decisions on the amount of deer that can or should be removed to protect herd health and reduce impacts from deer browse.

#### **Adverse Impacts**

##### *Habitat Protection and Management*

Prescribed burning activities would continue to have negligible, indirect, short-term impacts to mammals. Even though burning intensity would vary across alternatives, these activities would be limited to pine-dominated habitats, where most mammal species have the mobility to leave these areas when activities are occurring. Species such as deer and gray fox are mobile enough to forest management activities. Burning alone may decrease habitat quality and create a population sink for small mammals. However, cotton mouse populations showed the highest growth and survival rates when burning was combined with thinning or herbicide operations, which may open up the canopy to increase herbaceous vegetation for forage and cover. Survival rates were increased as compared to burning alone or control sites within pine forest habitats (Sharp et al. 2009). Prescribed burning occurs on designated burn units, and both thinning and burning are limited to the pine-dominated habitats. The mature moist hardwood forest and floodplain forest, which are the habitats used by many mammal species, would not be subject to these management activities.

Invasive species control would continue to have negligible, direct, short-term impacts to small rodents because they would experience loss of cover vegetation. While small rodents are mobile, they have limited distances that they can travel to escape disturbances. Herbicide application using equipment such as vehicles would initially cause noise disturbance and impact foraging behaviors. After application, treated vegetation that they use for cover from predators such as raptors and foxes would be decreased, exposing them to a greater risk of predation. Impacts would be limited because of small targeted areas for treatment. Exposure to herbicides during treatment is not believed to impact individuals, as most chemicals degrade quickly and target plant processes specifically so as not to impact fish or wildlife when used properly (Tatum 2004). Staff would only use herbicides approved by the national contaminants coordinator.

*Public Use and Access*

The hunt program would continue to have negligible, direct, long-term impacts on non-target mammals because their interactions with humans would continue to be rare. Under all alternatives, hunting on the refuge occurs during specific, narrow time periods. Based on the number of hunters, the number of hunt days, and the areas designated for hunting, adverse interactions between humans and non-target mammals during the hunt season(s) would be rare.

**4.10.2 Mammal Impacts of Alternative A****Beneficial Impacts***Habitat Protection and Management*

Thinning in the pine-dominated forest habitat would have minor, direct, long-term impacts to mammals because opening the canopy will increase size of mature trees and provide light for herbaceous vegetation. Larger trees typically have more cavities, which provide areas for nesting. Gray squirrels, raccoons, and other mammal species that nest in tree cavities would benefit from forest management activities that increase tree size. Small mammals would benefit from the combination of thinning operations with burns to increase herbaceous vegetation that will produce cover and seeds as food source (Sharp et al. 2009).

Protection of the mast producing trees in the pine-dominated forest during forest management activities would have minor, direct, long-term impacts to mammals. Oaks and other mast producing trees are an important food resource for a variety of mammals, including gray squirrels and deer. Protecting these trees during thinning and prescribed burns ensures that this food resource remains available for these species. Many tree species do not start producing masts until they reach a certain size or age, so maintaining these trees would provide a consistent food resource. Maintaining hardwood mid-story also provides cover for small and medium-sized mammals, such as raccoons, from predators and weather.

*Public Use and Access*

Same as the impacts that do not vary among alternatives.

**Adverse Impacts**

Same as the impacts that do not vary among alternatives.

**4.10.3 Mammal Impacts of Alternative B****Beneficial Impacts***Habitat Protection and Management*

Forest management under alternative would have the same impacts on mammals as detailed in alternative A.

*Public Use and Access*

Increased public access to trails for wildlife photography, observation, interpretation and education would result in negligible to minor, indirect, short-term impacts as knowledge and appreciation of mammalian species and their habitats is fostered.

**Adverse Impacts***Habitat Protection and Management*

Thinning in the pine-dominated forest would have minor, direct, short- and

long-term impacts to mammals because of noise disturbance and because these activities would result in reduced food resources and midstory cover. The resulting pine savanna habitat would have reduced food resources for fox squirrels and other mammals because this forest management approach would favor large, mature pine trees with a dense, herbaceous understory and limit hardwood mast producing trees. We expect impacts to mammal populations would be minimized because oaks are present in the neighboring mature moist hardwood and floodplain forest would continue to provide food resources.

*Public Use and Access*

Expansion of a 3-mile nature trail, construction of a wildlife observation and photography blind and a fishing platform, improvement of the existing canoe/kayak launch, and increase in refuge visitation in the designated public use area would have negligible, indirect, long-term impacts to mammals. Human disturbance would potentially cause mammals to flee. Similar to birds, mammals can flee in response to human disturbance (Knight and Cole 1991). Females with young are more likely to flee from disturbance than those without young (Hammit and Cole 1998). We would minimize impacts to mammals by requiring visitors to stay on trails (Miller et al. 2001) and to stay out of sensitive areas.

**4.10.4 Mammal Impacts of Alternative C**

**Beneficial Impacts**

*Habitat Protection and Management*

Beneficial impacts to mammals due to thinning activities would be similar to alternative B.

Converting the pine-dominated forest to a transitional dry hardwood forest would have minor, direct, long-term impacts to mammals because this forest management approach would seek to increase mast producing trees, resulting in improved foraging opportunities. The forest composition of the transitional dry hardwood forest contains more white oak and pignut hickory trees, which would produce nuts for small mammal use more so than in the pine-dominated forest under either alternatives A or B. These trees would remain dominant in the tree community over the next 80 years.

Converting the pine-dominated forest to a transitional dry hardwood forest would result in larger logging decks that we would manage as grasslands, conveying a negligible to minor, direct, and long-term impact on mammals. These non-forested upland areas would serve as feeding sites for mammals. Small rodents eat seeds produced by herbaceous vegetation. Foxes prey on the small rodents found in this habitat. Squirrel species forage for hard masts dropped from adjacent trees. The open grasslands would provide additional habitat diversity for mammal species that prefer to forage in areas with no to little tree canopy.

*Public Use and Access*

Increased public access to trails and wildlife drive for wildlife observation, photography, environmental education, and interpretation would result in negligible to minor, indirect, short-term impacts as knowledge and appreciation of mammalian species and their habitats is fostered.

**Adverse Impacts***Habitat Protection and Management*

Thinning in the pine-dominated forest would have negligible, direct, short- and long-term impacts to mammals because of noise disturbance associated with thinning operations. These operations would be limited to only one or two occasions, so the disturbance would not be lasting.

*Public Use and Access*

Adverse impacts on mammals due to improvement of existing and construction of new infrastructure would have the same impacts as under alternative B.

Construction, maintenance, and use of the 2-mile wildlife drive would have minor, direct, short- and long-term impacts. Increased vehicle traffic could disrupt mammal movement, or result in injury or mortality of individuals by collision. We would mitigate possible conflicts through interpretative materials such as making brochures available and utilizing kiosks to educate refuge users on bald eagle or other species use along the roadways. We would also posts signs along the roadway that would encourage drivers to use caution and provide an educational message such as “Give wildlife a break.”

**4.11 Amphibians and Reptiles**

We compared the management actions in the alternatives based on their potential to benefit or adversely affect the refuge’s amphibians and reptiles. The benefits we considered included:

- Protection and restoration of native habitats.
- Reduction in invasive plants.

The potential adverse impacts of the alternatives that we evaluated included impacts from:

- Forest management activities.
- Application of herbicides for invasive species control activities.
- Increased visitation.

**4.11.1 Amphibian and Reptile Impacts That Would not Vary by Alternative****Beneficial Impacts***Habitat Protection and Management*

Preserving the mature moist hardwood forest and floodplain forest would continue to provide moderate, direct, short- and long-term impacts to amphibians and reptiles. These habitats are important wintering, breeding and foraging habitat for amphibians and reptiles on the refuge and required to complete their entire life cycle. Continuous, intact mature hardwood forest provides safe movement for amphibians between breeding pools and wintering burrows (Regosin et al. 2005). Snags and downed timber are also used for shelter by both reptiles and amphibians. The eastern box turtle needs leaf litter and soil for burrowing under hardwood forests to meet wintering habitat requirements (Erb 2011).

Invasive plant species control in mature moist hardwood forest, floodplain forest, and freshwater marsh and shrub swamp would have negligible, indirect, short- and long-term impacts to amphibians and reptiles because the natural hydrology of these habitats would be protected and native plant species, which are important food resources for amphibians and reptiles, would remain undisturbed. As discussed, invasive plant species can change habitat conditions where they become established. Common reed, one potential invasive species not yet observed on the refuge, has been shown to decrease native plant abundance (Marks et al. 1994) and decrease native plant diversity (Meyerson et al. 2000). The natural hydrology of habitats invaded by common reed can be altered, reducing breeding ponds or access to water sources by creating thick vegetation mats (Chambers et al. 1999). Therefore, preventing infestations of common reed in the refuge's mature moist hardwood forest, floodplain forest, and freshwater marsh and shrub swamp would be beneficial to amphibians and reptiles.

*Public Use and Access*

None identified.

**Adverse Impacts**

*Habitat Protection and Management*

Invasive species control would result in minor, indirect, short-term impacts to amphibians and reptiles because herbicide applications would reduce vegetation cover that these species may use. Amphibians and reptiles rely on vegetation to help protect them from predators, find prey, and regulate body temperature and moisture (deMaynadier and Hunter 1999, Nuzzo and Mierzwa 2000). Herbicide applications would result in the reduction of existing, invasive plant species and would potentially increase the local ground temperature and decrease the local humidity due to increased sunlight exposure (Herb et al. 2008). Impacts due to invasive species control would be minimized by encouraging or establishing native vegetation regrowth to take the place of the invasive species and offsetting the impacts of vegetation removal. There would be no direct impact from herbicide chemicals to amphibians or reptiles because applications would only be done in accordance with labels and pesticide management plans. Though amphibians are thought to be sensitive to herbicides, research suggests that they respond similarly to other aquatic organisms. In addition, herbicides used do not persist in the system and are designed to target unique plant processes, so they pose low toxicity to animals (Tatum 2004).

*Public Use and Access*

None identified.

**4.11.2 Amphibian and Reptile Impacts of Alternative A**

**Beneficial Impacts**

*Habitat Protection and Management*

Tree removal in the pine-dominated forest would have minor, direct, long-term impacts on amphibian and reptile species by increasing herbaceous and invertebrate food sources and increasing mobility and cover through the habitat. Opening of the canopy and thinning midstory would allow light and opportunity for herbaceous plant species to flourish. As these areas are being opened up we are already noticing an increase in invertebrate activity over areas that have not been thinned or burned. Native herbaceous vegetation

that would result from this structure change would also increase mobility of these species by providing space for movement and cover. The prescribed burning operations in this management process would also increase snags and downed timber, which would not only increase invertebrate species for foraging but also provide shelter for both amphibian and reptile species.

*Public Use and Access*

Same as the impacts that do not vary among alternatives.

**Adverse Impacts**

*Habitat Protection and Management*

Prescribed burning and thinning operations would have minor, direct, short-term impacts to amphibian and reptile species. Not all individuals will be able to escape mortality during operations; however, impacts will be limited due to the small sizes of treatment units. Also, the burning of leaf litter and debris will temporarily eliminate areas of cover but effects will not last long as vegetation responds quickly after a prescribed fire event (Knapp et al. 2009).

*Public Use and Access*

The existing 0.5-mile nature trail provides negligible, direct, long-term impacts because the trail intersects forest habitat and certain amphibian species avoid roadsides or forest openings in their movements (Regosin et al. 2005). This interruption of habitat and avoidance response by various species could prevent individuals from reaching breeding ponds or suitable wintering habitat. However, this only affects a small portion of the refuge.

**4.11.3 Amphibian and Reptile Impacts of Alternative B**

**Beneficial Impacts**

*Habitat Protection and Management*

Forest management for the pine-dominated habitat under alternative B would provide moderate, direct, long-term impacts to amphibians and reptiles because the resulting pine savanna would provide an open understory that would allow light and opportunity for herbaceous plant species to flourish. Thinning and prescribed burning would reduce the canopy and would result in an open midstory with a dense, herbaceous understory, which would be preferred by several reptile species, including the hognose snake. Increased herbaceous vegetation will provide food and increase invertebrates. The number of trees per acre would be reduced to 200 trees per acre within 10 years of CCP approval, and a mature pine stand with increased snags and downed timber would provide reptiles with cover and foraging (Faccio 2003).

*Public Use and Access*

Increased public access to trails for wildlife photography, observation, interpretation and education would result in negligible to minor, indirect, short-term impacts as knowledge and appreciation of amphibian and reptile species and their habitats is fostered.

**Adverse Impacts**

*Habitat Protection and Management*

Thinning, prescribed burning, and ground disturbing activities in the pine-dominated forest would result in minor, direct, short-term impacts to amphibians and reptiles because equipment would compact the soil while these activities were taking place. Reptiles and amphibians require moist, loose soil to hunt for prey, escape predators, and regulate body temperature

and moisture. Soil compaction and disturbance from management activities involving equipment would affect this component of the habitat. Restricting thinning and burning equipment to small sites with dry soils when disturbance would be limited would minimize soil compaction.

*Public Use and Access*

Construction of the 3-mile nature trail, a wildlife observation and photography blind, and a fishing platform would result in minor, direct, short- and long-term impacts. Construction would be for a finite time and would be focused in only one small area of the refuge. The trail may limit movements of some amphibians to and from breeding ponds or wintering areas but again this trail will be concentrated on a small corner of the refuge to limit impacts to the larger contiguous forest.

Expansion of a 3-mile nature trail, construction of a wildlife observation and photography blind and a fishing platform, improvement of the existing canoe/kayak launch, and increase in refuge visitation in the designated public use area would result in negligible, direct, short-term impacts to amphibians and reptiles. Trampling and harassment by refuge visitors using the 3-mile nature trail and walkways to and from other public use areas would be the largest potential impact to amphibians and reptiles. We would require visitors to stay on the trail to minimize impacts and limit foot traffic to a designated area.

#### **4.11.4 Amphibian and Reptile Impacts of Alternative C**

##### **Beneficial Impacts**

*Habitat Protection and Management*

Converting the pine-dominated forest to a transitional dry oak hardwood forest would result in moderate, direct, long-term impacts to amphibians and reptiles because the transitional dry hardwood forest would be contiguous with the existing mature moist hardwood and floodplain forests and help to provide travel corridors for amphibians and reptile species movement. Research on fragmentation of Costa Rican forests on reptiles and amphibians noted 34 percent of species as sensitive to fragmentation because they were either absent or found in low numbers in forest fragments (Bell and Donnelly 2006). In Pennsylvania, certain salamander species selected breeding ponds farther from logging roads while more generalist species were not influenced in their selection (Chambers 2008). Eastern box turtles show greater movement through contiguous forest habitats (Iglay et al. 2007). Under alternative C, the resulting forest cover in the transitional dry oak hardwood forest would provide better conditions to allow amphibians and reptiles to travel back and forth across the landscape.

*Public Use and Access*

Increased public access to trails for wildlife photography, observation, interpretation and education would result in impacts similar to alternative B.

##### **Adverse Impacts**

*Habitat Protection and Management*

Clear cutting or selective cutting of the pine-dominated forest would result in moderate, direct, short-term impacts to amphibians and reptiles because these activities would result in ground disturbance. To achieve the targeted tree composition, these areas would need to be clear cut or selectively cut using large forestry equipment. As previously discussed, many amphibian

and reptile species would be adversely impacted by activities that remove vegetation, disturb soil, and compact soil, resulting in changes to the local microclimate. We would minimize the impacts to amphibians and reptiles by implementing best management practices for forest thinning activities. Cutting operations and increasing non-forested upland areas would also create openings that might affect local pool-breeding amphibians if it occurs within approximately 219 yards (200 meters) of breeding pools (Regosin et al. 2005). If possible, we would site new, larger logging decks more than 219 yards (200 meters) from breeding pools to limit impacts to amphibians.

#### *Public Use and Access*

Impacts that would come from construction and increased visitor use of the 3-mile nature trail, wildlife observation platform, and canoe/kayak launch would be similar to alternative B.

Construction, maintenance, and use of the 2-mile wildlife drive would have minor, direct, short- and long-term impacts. Increased vehicle traffic could disrupt amphibian and reptile movement, or result in injury or mortality of individuals by collision. We would mitigate possible conflicts through interpretative materials such as making brochures available and utilizing kiosks to educate refuge users on bald eagle or other species use along the roadways. We would also post signs along the roadway that would encourage drivers to use caution and provide an educational message such as “Give wildlife a break.” Increased vehicle traffic from the above activities and visitor use would increase mortality of both amphibians and reptiles, especially snake species.

## 4.12 Invertebrates

We compared the management actions in the alternatives based on their potential to benefit or adversely affect the refuge’s invertebrates. The benefits we considered included:

- Forest structure management.
- Protection of native habitats.
- Reduction of invasive plants.

The potential adverse impacts of the alternatives that we evaluated included impacts from:

- Forest management activities.
- Herbicide application for invasive species control.

### 4.12.1 Invertebrate Impacts That Would not Vary by Alternative

#### **Beneficial Impacts**

##### *Habitat Protection and Management*

Timber removal operations would provide minor to moderate, direct, short- and long-term impacts of invertebrate diversity and populations. Hanson et al. (2009) noted that seasonal ponds in units where timber was harvested favored greater invertebrate richness compared to un-harvested sites. This

may be due to changes in light, vegetation, or other variables that could change after tree removal. In all alternatives the former dense pine plantation will be opened and would impact seasonal ponds. Opening the canopy would also allow increase of herbaceous vegetation that provides foraging and cover for many invertebrates. Areas that are already receiving burn and thinning treatments are showing noticeably more invertebrates than those units that remain untreated. In other pine forests, 10 taxa of arthropods showed higher associations with locations that had at least some burn regime (Hanula et al. 2009).

Protection of the mature moist hardwood forest and floodplain forest would continue to provide minor to moderate, direct, long-term impacts to invertebrates. Limiting disturbance and management activities would increase the number of snags and woody debris available as the forests continue to age. Many invertebrate species use woody debris for food and cover throughout at least one part of their life cycle. Limiting ground disturbing activities in the floodplain forest also protects the hydrology of areas with longer hydroperiods, which can support the greatest diversity of invertebrates (Dietz-Brantley et al. 2002). Hardwood depressions should also be a focus of protection because of the rare invertebrates they accommodate (Battle and Golladay 2002).

Protection of freshwater marsh, shrub swamp, and aquatic habitats would have moderate, direct, long-term impacts on invertebrate populations. Woody debris in wetland habitats supports both aquatic and non-aquatic invertebrate populations that are essential to all refuge habitats (Braccia and Batzer 2001).

Increased monitoring of invasive plant and animal species would result in minor, indirect, long-term benefits to invertebrates because we would prevent a decline in native invertebrate species caused by changing habitats conditions resulting from invasive species. Invasive species would have the potential to change habitat conditions or ecological processes required by native invertebrate species on the refuge (Miller et al. 2010). For example, an invasive plant may out-compete a native plant species, which is the only food resource for a particular invertebrate species. Monitoring would allow us to identify the presence of invasive species and implement management actions to control or remove it before it adversely impacts invertebrate populations.

#### *Public Use and Access*

None identified.

#### **Adverse Impacts**

##### *Habitat Protection and Management*

Prescribed burning activities in the pine-dominated forest would result in minor, direct, short-term impacts to invertebrates because a decrease in invertebrate abundance would directly result from a prescribed burn. Fire, whether a wildfire or prescribed burn, has been shown to reduce invertebrate abundance from immediately after a fire and up to 2 months after a fire has occurred (Swengel 2001). Immobile invertebrates present at the ground surface on understory vegetation are more impacted than invertebrates below the ground, under logs and materials left unburned, that are present above the flame lengths, or have a high degree of mobility. Long-term impacts to invertebrates would be minimized because we would use

prescribed burning to control or reduce fire intensity. Panzer (1988) indicates that even after intense fires, which are beyond the fire prescription, 100 percent mortality of the most fire-vulnerable invertebrates would be rare. Following a prescribed burn and revegetation of the unit, invertebrates from neighboring unburned areas would recolonize burned areas.

Invasive species control would result in minor, indirect, short-term impacts to invertebrates in areas where invasive species are present. Applying herbicides would remove vegetation, which some invertebrates may utilize as a food resource. We would anticipate that many invertebrate species would positively respond to an increase in native plant species diversity over the long term. No or negligible, direct, short-term impacts would occur due to contact with herbicides because all label and plan guidelines would be executed and herbicides used would be non-persistent and specifically target plant species (Tatum 2004).

Thinning and prescribed burning activities in the pine-dominated forest would result in minor, direct, long-term impacts to pine beetles. Increasing the distance between individual pine trees limits the spread of the southern pine beetle through the entire stand. Reducing pine density in multiple, adjacent stands reduces the potential for a pine beetle infestation to spread to other pine-dominated forests on the refuge. Where pine density objectives were achieved, the refuge's pine-dominated forests would be less vulnerable to pine beetle infestation from adjacent forests, beyond the refuge boundary. Pine trees have also shown an increase in resin production after prescribed burning which increases defense to southern pine beetle infestation (Knebel and Wentworth 2007).

*Public Use and Access*

None identified.

#### **4.12.2 Invertebrate Impacts of Alternative A**

**Beneficial Impacts**

Same as the impacts that do not vary among alternatives.

**Adverse Impacts**

Same as the impacts that do not vary among alternatives.

#### **4.12.3 Invertebrate Impacts of Alternative B**

**Beneficial Impacts**

*Habitat Protection and Management*

Transitioning the pine-dominated forest to a pine savanna would result in moderate, direct, long-term benefits to invertebrates. The frequency of fire can drive arthropod community structure with an increase in many taxa correlated with increased fire frequency (Hanula et al. 2009). The savanna habitat would have an increased open understory as compared to alternative the other alternatives, which would increase the abundance and diversity of forb species that invertebrates could feed on.

*Public Use and Access*

Same as the impacts that do not vary among alternatives.

### **Adverse Impacts**

#### *Habitat Protection and Management*

Prescribed fire used to maintain the pine savanna habitat would have minor, direct, short-term impacts to invertebrate populations. In a Florida savanna, ant species richness was lower 6 months post-fire than during the same month 6 months before the burn; adaptations of ants to a fire regime is suspected to have contributed to the rapid post-fire recovery of the ant community (Izhaki et al. 2003).

#### *Public Use and Access*

Same as the impacts that do not vary among alternatives.

## **4.12.4 Invertebrate Impacts of Alternative C**

### **Beneficial Impacts**

#### *Habitat Protection and Management*

Conversion to a mixed pine-hardwood forest that requires little forest management will have minor, direct, long-term impacts to invertebrate populations. Forest management practices like removal of forest understory can disturb the ecosystem by suppressing high-trophic groups of soil invertebrates (Zhao et al. 2013) After units have been thinned and burned to set back pine species there will be no major management actions disturbing the forest floor.

#### *Public Use and Access*

Same as the impacts that do not vary among alternatives.

### **Adverse Impacts**

#### *Habitat Protection and Management*

Clear-cuts during the pine to hardwood transformation process are likely to have moderate, direct, short-term impacts on invertebrate populations. In a North Carolina study of impacts of small-scale forestry, macroinvertebrate species richness and diversity was low in streams that drained clear-cut sites and that invertebrate diversity increases with forest regrowth (Goodman et al. 2006).

#### *Public Use and Access*

Same as the impacts that do not vary among alternatives.

## **4.13 Public Use and Access**

The Refuge Improvement Act identifies six priority wildlife-dependent public uses that should receive enhanced consideration when planning on national wildlife refuges: hunting, fishing, wildlife observation, photography, environmental education, and interpretation. Because the Service holds refuge lands in the public trust, access is generally allowed for compatible, priority wildlife-dependent public uses. Uses are limited when Federal Trust resources will be impacted; the activity will detract from achieving refuge purposes or the Refuge System mission; or when administrative resources are not available to ensure a safe, quality experience.

James River NWR is currently open to hunting, specifically of white-tailed deer, and environmental education. Hunting and interpretation have been

identified as two of the public use areas of emphasis for the Eastern Virginia Rivers NWR Complex as a whole (USFWS 2010b). In addition to its purpose to provide nesting and roosting habitat for bald eagles, James River NWR was established to provide an opportunity to view wildlife in its natural environment, so that the public may better appreciate the refuge's role in conservation of wildlife resources (USFWS 2010b).

We evaluated the following management actions for their potential beneficial or adverse impacts on hunting that would result from implementing of the alternatives:

- Habitat management activities.
- Opening existing refuge areas for approved public access and appropriate, wildlife-dependent activities.
- Improving or constructing visitor infrastructure.
- Collaborating in partnerships with local, regional, and state recreation interests.
- Improving outreach and Service visibility.

We considered the following potential direct and indirect, short- and long-term impacts on public use and access that could result from the actions above:

- Conflicts among users—both actual (e.g., consumptive vs. non-consumptive) and perceived (e.g., outreach for one activity may deter the interest of other users).
- Conflicts among uses (e.g., conflicts about safety and access).
- Changes in use.
- More informed public (e.g., about species, their habitats, and their conservation).
- More supportive public (e.g., of the refuge, the Refuge System, and the Service).
- Increases in visitation and its associated impacts on the quality of the experiences and our ability to meet the demand.

#### **4.13.1 Public Use and Access Impacts That Would not Vary by Alternative**

Regardless of the alternative selected, we would continue to allow access to the refuge for two of the six priority public uses on the refuge, hunting and environmental education. All of the existing trail and wildlife observation facilities would be maintained.

##### **Beneficial Impacts**

###### *Habitat Protection and Management*

None identified.

#### *Public Use and Access*

Continuing to offer quality deer hunting opportunities on the refuge would result in minor to moderate, direct, short- and long-term impacts on the hunting community. According the 2011 National Survey of Fishing, Hunting and Wildlife-Associated Recreation (USDOI et al. 2013), the number of hunters in Virginia rose 22 percent in the past decade, from 355,000 in 2001 to 432,000 in 2011, while hunting trends nationally indicate a decline. The refuge's hunts are the only public hunt within Prince George County. The only other public property offering hunting opportunities to the local communities within a 25-mile radius of James River NWR is Presquile NWR. Refuge hunt participants enjoy and develop an appreciation for the refuge, as well as for nature and wilderness in general. In the long term, we would strive to improve hunter understanding and appreciation for the refuge purpose as a bald eagle sanctuary through increased communications and outreach. Our annual review of the refuge's hunt program with VDGIF would benefit the refuge by ensuring a harvestable surplus of deer exists and that a quality recreational hunt can be offered annually on the refuge.

Continuing to offer environmental education programs on the refuge would result in negligible, direct, short- and long-term impacts for refuge visitors.

#### **Adverse Impacts**

##### *Habitat Protection and Management*

We limit public use and access to areas of the refuge and during certain times of the year to ensure that we fulfill our biological management objectives for the protection bald eagles and their habitat, resulting in negligible to minor, direct, long-term impact on public use of and access to the refuge. Under all alternatives, we would continue to impose geographic and time-of-year restrictions on public use as needed to achieve our biological management objectives and protect public health and safety. For example, we would continue to:

- Prohibit public use and access on the refuge in pine-forests actively being managed using thinning or burning to protect public health and safety.
- Assign deer hunters specific deer hunting locations.
- Not offer public deer hunting opportunities after December 14 to avoid impacts to nesting bald eagles.

##### *Public Use and Access*

Geographic and time-of-year restrictions would continue to be imposed on refuge visitation. Our paramount priority is to protect bald eagles and their habitats, which means that such restrictions are necessary. To date, such restrictions have resulted in negligible, direct, long-term impacts on refuge visitors, most notably the refuge's deer hunt participants. Since our first public deer hunt on the refuge, we have imposed geographic and time-of-year restrictions on the refuge's deer hunt to protect nesting bald eagles. Each year, we receive a limited number of requests from hunters that we extend our deer hunting season beyond the December 14 end date. We anticipate that we will continue to receive such requests as bald eagle populations on the Lower James River continue to improve and as interest in the refuge's deer hunt increases. In the short- and long-term, we would strive to minimize and eliminate the potential for hunter dissatisfaction associated with our managed

hunts. We would continue to communicate openly and often with hunt participants about the importance of protecting habitat on the refuge, as well as the steps we take to avoid and reduce the potential for eagle disturbance during the refuge hunts. Geographic and time-of-year restrictions are also taken into account when environmental education program plans and schedules are being developed.

#### **4.13.2 Public Uses and Access Impacts of Alternative A**

##### **Beneficial Impacts**

###### *Habitat Protection and Management*

Protection and management of wildlife habitats on the refuge would result in moderate, indirect, short- and long-term impacts on public use and access to the refuge. Our thinning and prescribed burn activities in the pine-dominated forest and protection of the floodplain forest help to ensure that native wildlife, including bald eagles, find suitable and abundant nesting, roosting, and feeding habitats, which in turn provide opportunities for wildlife observation, photography, environmental education, and interpretation. Our habitat management actions are for the benefit of the wildlife that visitors to the refuge view and learn about in our environmental education programs and interpretive materials.

###### *Public Use and Access*

Refuge visitors acquire permits to participate in our deer hunt, wildlife observation, photography, environmental education, and interpretation programs, each of which provides refuge visitors with opportunities to make meaningful connections with nature. Such opportunities are rare in Prince George County, where open space managed specifically for wildlife is limited. The existence of the refuge results in a minor, direct, long-term impacts on refuge visitors.

##### **Adverse Impacts**

###### *Habitat Protection and Management*

Our habitat protection and management activities would continue to result in minor, direct, long-term impacts to public use and access. We currently have one full-time refuge employee whose time is dedicated to planning, supervising, and directing all habitat protection and management activities at James River NWR, Presquile NWR, and Plum Tree Island NWR. Because the purpose of James River NWR is to protect and maintain bald eagle habitat, we focus our funding and staff resources on accomplishing this objective. Our primary habitat management activities focus on thinning and burning in the pine-dominated forest. To ensure public health and safety, we offer limited public use and access to the refuge. Refuge roads would remain unimproved, rugged roads that would be used to support the refuge's forest management activities. Because the majority of the refuge's pine-dominated forest is overstocked and dense, we anticipate logging equipment and tractor trailers would continue to periodically occupy ever-changing tracts within the forest.

The lack of trail infrastructure (including parking, restrooms, and signage) and competing non-compatible habitat management actions limits promotion of non-wildlife consumptive uses. The impacts from this lack of infrastructure and designated public use space on public use and access is moderate and direct over both the short and long term.

*Public Use and Access*

We would continue to use permit system and require that visitors obtain a permit three days prior to their visit for any public access that is not a refuge-sponsored event. This requirement may result in minor, direct, short-term impacts to visitors who want to visit the refuge while they are in the area for a short period of time, or were not able or aware of the permit requirement prior to their desired visit.

During the refuge's deer hunting season, the refuge is closed to wildlife observation, photography, environmental education, and interpretation. This closure occurs during the fall season. Impacts from any conflicting public use is minor, direct, and short term.

**4.13.3 Public Uses and Access Impacts of Alternative B**

**Beneficial Impacts**

*Habitat Protection and Management*

Our habitat management activities, especially the thinning and burning activities in the pine-dominated forest, would have a negligible, direct impact on refuge hunting opportunities in the short and long term. The expanded pine thinning operation would transform the dense, overstocked pine stands into a more open landscape, allowing better viewing by hunters (Brame 2013 personal communication).

Ongoing habitat protection and management within the floodplain forest, freshwater marsh and shrub swamp, and aquatic habitats would have minor, indirect, long-term impacts on fishing opportunities by helping to protect water quality and maintain suitable fish habitat.

Our habitat management activities, especially the thinning and burning activities in the pine-dominated forest, would have negligible, direct, long-term impacts on wildlife observation, photography, environmental education, and interpretation opportunities. Opening up the forest would increase visibility and possibly provide more opportunity for wildlife observation. Habitat management actions on the refuge would potentially be connected to an environmental education curriculum related to land management.

*Public Use and Access*

Our proposed expansion to the refuge's hunt program would address the public's interest in expanding existing hunt opportunities, as well as allowing new hunt opportunities on the refuge.

Expanding the refuge's deer hunt program would result in moderate, direct, short- and long-term impacts on the hunting program. We anticipate that the deer hunting program would benefit from our efforts to increase the total number of deer hunting opportunities on the refuge. Up to 70 hunters can be accommodated on each of our 3 muzzleloader hunter use days, on a first-come, first-served basis. We anticipate that the refuge would see an increase in hunter participation by those who have previously on hunted the refuge, as well as attract hunters who have not previously participated in our hunts. We know that participants in our muzzleloader hunting season have a higher rate of success than hunters participating in the refuge's archery or shotgun season (Brame 2013 personal communication). We anticipate that increasing the muzzleloader hunting opportunities by one day over alternative A would increase the number of muzzleloader hunters that may enjoy this higher rate

of success.

Opening the refuge to turkey and waterfowl hunting would help to attract new hunters to the refuge specifically for turkey or waterfowl hunting. We anticipate that the local hunting community would benefit from the refuge offering these new hunting opportunities, but additional NEPA review and analysis is required to fully characterize the impacts of our proposal to open the refuge for these new hunts.

Construction of a wildlife observation blind that would serve as waterfowl hunting blind on specific dates in the year would provide minor, direct, short- and long-term impacts to refuge visitors. During the 30 waterfowl hunter use days, only waterfowl hunters would be permitted to use the blind and nearby 500 feet of trail; all other refuge visitors would be excluded from this area to promote safe hunting and refuge visits. Throughout the rest of the year, the blind and nearby trail would be open to refuge visitors engaging in wildlife observation, photography, environmental education, and interpretation.

As a refuge within 25 miles of a major metropolitan area, the Service considers James River NWR to be an urban refuge, with the potential to attract people of all ages from the surrounding metropolitan, suburban, and rural communities to build connections with nature. By offering a diversity of hunting opportunities, including opportunities and educational programs to introduce youth to hunting, we would be able to engage with the diverse communities in the Richmond metropolitan area. By providing a separate youth hunt days on the refuge, we would contribute positively to the State and Service's goals of developing a new generation of hunters and fostering a sense of stewardship for the environment. Our proposed renovation of the hunter check station into a visitor contact station that resembles a traditional hunting and fishing lodge would help to promote this sense of stewardship and establish a conservation ethic. The visitor contact station would serve as the place on the refuge where refuge visitors learn more about hunting and gain a better appreciation for the role of hunting on national wildlife refuges. In the short- and long-term, we anticipate that refuge visitors would directly benefit from learning more and engaging in the hunting-related opportunities and experiences we would offer at James River NWR. Beneficial impacts could be accessed through participation increases in refuge hunting opportunities (as identified in the objectives), and formal and informal surveys.

Opening James River NWR to recreational fishing at two designated locations for up to 1,460 anglers annually would result in moderate, direct, long-term impacts to the recreational fishing community by increasing recreational fishing opportunities and access to fishing information along the Lower James River. We would coordinate closely with VDGIF to keep informed about State fishing regulations, trends in fish populations, and disease outbreaks in fish to most effectively manage the fishing program at the refuge. This coordination would benefit the fishing program and user by keeping them informed and aware of current fisheries related news.

We would improve the infrastructure at the canoe/kayak launch site to establish it as a fishing location. Improvements at this site would also facilitate hand-launching canoes, kayaks, and non-trailerred boats with small electric motors for fishing access to Powell Creek. At the second fishing

location, we would create infrastructure that supports fishing without eroding streambanks. To facilitate access to the fishing locations, we would improve and maintain roads and parking areas. These improvements would result in moderate, direct, long-term impacts to those wanting to fish at the refuge.

Expanding the nature trail would create minor, direct, long-term benefits to those visitors who want to engage in wildlife observation, photography, environmental education, and interpretation on the refuge. This increase would potentially introduce a larger audience of people to hunting and fishing opportunities on the refuge and result in increased hunting and fishing participation. The impact would be negligible and indirect for the short term, but minor and direct in the long term.

Until signage and visitor support facility improvements are completed, require participants to request a refuge-issued permit 3 business days in advance of proposed visit. Once completed, we would eliminate the need for visitors to obtain a permit in advance of their visit, which would have moderate, direct, long-term impacts as it would allow for the public to visit the refuge at their convenience. Opening the refuge to less restrictive entry is one way that the refuge staff can help increase public access to wildlife observation, photography, environmental education, and interpretation opportunities and programs. Targeting urban audiences would attract new participants to the facilities associated with the public use program, especially in refuge- and partner-sponsored programs and events. We anticipate the impacts from promoting to an urban audience to be negligible, direct, and long term.

Expanded programming, including two wildlife observation boat trips, would provide opportunity for the public to participate in additional non-consumptive uses.

With expansion of the nature trail and a designated public use area a greater number of visitors participating in wildlife observation, photography, environmental education, and interpretation would use the refuge for reasons other than for hunting or fishing. Additional enhancements to the refuge, including the improved canoe/kayak launch, wildlife observation sites, and expanded parking would have moderate, direct, long-term impacts.

### **Adverse Impacts**

#### *Habitat Protection and Management*

Increased pine thinning activity under alternative B would result in negligible, direct, short-term impacts to deer and turkey hunters by periodically removing hunt locations where thinning is being actively performed. However, as we have more hunt stands now than are currently being used, this activity is not anticipated to have any lasting impact on the hunt because the hunters can hunt from other non-affected locations.

Increased pine thinning activity under alternative B would result in minor, direct, short-term impacts to wildlife observation, photography, environmental education, and interpretation by limiting the public's ability to access certain portions of the public use area while these activities are occurring.

*Public Use and Access*

To accommodate the expanded nature trail, we would eliminate 16 hunting locations that are currently located near the proposed trail location. While these impacts would be direct and long term, they would be negligible because these hunting locations have had low to marginal harvest success compared to other designated sites within the refuge and because expanded opportunities in other parts of the refuge would accommodate the hunters and offer the potential for greater harvest success.

Any noise or refuge disturbance associated with the construction of the expanded trail, the wildlife observation sites, the canoe/kayak launch, and the expanded parking would be negligible, indirect, and short-term related to the hunt program. Aside from the area of proposed trail construction, creating other infrastructure for wildlife observation, photography, environmental education, and interpretation opportunities would have no impact to the hunt program because we would locate those opportunities on other portions of the refuge and away from approved hunting zones.

With regard to the hunt program, any possible impacts to fishing would depend upon the location of the fishing sites and their relationship to the location of the youth waterfowl hunting sites during the 10 days of the youth waterfowl hunt. At a maximum, fishing would be prohibited from a site for 10 days during the winter. However, if the waterfowl hunt occurs in an area where fishing is not allowed during the year, then no impact would result to fishing.

With improvements and expansion of the wildlife observation program, a variety of users engaged in wildlife observation, photography, environmental education, and interpretation would utilize the refuge for reasons other than fishing. These users would potentially cause minor, direct, short- and long-term impacts to the fishing experience by making noise or occupying space around designated fishing areas. Operators of canoes, kayaks, or non-trailerred, hand-launched boats with small electric motors would also possibly have minor, direct, short-term impacts to fishing areas when they are either launching or retrieving watercraft or paddling near fishing lines, by disturbing waters adjacent to fishing sites.

To make fishing viable, we would conduct minor infrastructure improvements, which would have negligible to minor, direct, short-term impacts to fishing access during construction. We would work to minimize any possible conflicts between anglers and other users within the same areas by informing visitors that fishing is allowed only in limited designated locations.

The hunt program would have negligible to minor, indirect, and short-term impacts on visitors engaged in wildlife observation, photography, environmental education, and interpretation opportunities because hunt zones are located in other portions of the refuge and away from the approved public use area. Visitors may come into contact with hunters registering at the visitor contact station and along entrance roads. Visitor's experiences may be lessened if they hear gunshots or see harvested animals on hunter's vehicles departing the refuge. Actual or perceived impacts with hunting would only occur on a limited number of fall days, when non-consumptive public use is traditionally less. To mitigate any possible impact from hunting,

on hunt days we would post signs at the entrance sign that indicate a hunt is going on. In advance of the hunts, we would also have information posted on our website and kiosk. On the 10 youth waterfowl hunter use days we would close a small portion of the trail (likely less than 1,000 feet) to minimize the potential for user conflicts and safety concerns. The impact of the partial trail closure would be negligible, direct, and short term.

#### **4.13.4 Public Uses and Access Impacts of Alternative C**

##### **Beneficial Impacts**

###### *Habitat Protection and Management*

Forest management activities would have moderate, direct, long-term impacts on the deer hunt because increased visibility would be provided for hunters after approximately 10 years, when the tree height starts to create canopy that shades out volunteer trees.

Impacts to fishing would be the same as those under alternative B.

Forest management activities would have moderate, direct, long-term impacts to wildlife observation, photography, environmental education, and interpretation, by providing increased visibility for these activities after approximately 10 years, when the tree height of the transitional forest would reduce the density and improved visibility would result.

###### *Public Use and Access*

Our proposed expansion to the refuge's hunt program would address the public's interest in expanding existing hunt opportunities, as well as allowing new hunt opportunities on the refuge.

Expanding the refuge's deer hunt program would result in moderate, direct, short- and long-term impacts on the hunting program. We anticipate that the deer hunting program would benefit from our efforts to increase the total number of deer hunting opportunities on the refuge. Up to 70 hunters can be accommodated on each of our 4 muzzleloader hunter use days on a first-come, first-served basis. We anticipate that the refuge would see an increase in hunter participation by those who have previously hunted the refuge, as well as attract hunters who have not previously participated in our hunts. We know that participants in our muzzleloader hunting season have a higher rate of success than hunters participating in the refuge's archery or shotgun season (Brame 2013 personal communication). We anticipate that increasing the muzzleloader hunting opportunities by 2 days over alternative A would increase the number of muzzleloader hunters that may enjoy this higher rate of success. Additionally, we would modify the archery deer hunt to add 5 additional days and split the hunt into two 12-day seasons under alternative C to provide twice as many opportunities for a hunter to be selected in the lottery, resulting in minor, direct, long-term impacts to the archery deer hunt community.

Opening the refuge to turkey and waterfowl hunting would help to attract new hunters to the refuge specifically for turkey or waterfowl hunting. In addition to the turkey and waterfowl hunting opportunities under alternative B, we would also offer turkey-only hunting in the spring under alternative C. Turkey-only hunting is a different hunting approach than taking turkey while hunting for other species. Offering a spring turkey-only season would provide moderate, direct, long-term impacts to those hunter user groups who would

want to focus on just this hunting experience. We anticipate that the local hunting community would benefit from the refuge offering these new hunting opportunities, but additional NEPA review and analysis is required to fully characterize the impacts of our proposal to open the refuge for these new hunts.

Beneficial impacts to public uses and access related to the construction of a wildlife observation blind that would serve as a waterfowl hunting blind on specific dates in the year would be similar to alternative B.

Beneficial impacts to public uses and access related to expanding outreach to refuge visitors, including urban communities, would be similar to alternative B.

Opening James River NWR to recreational fishing at three designated locations for up to 2,190 anglers annually would result in moderate, direct, long-term impacts to the recreational fishing community by increasing recreational fishing opportunities and access to fishing information along the Lower James River. While alternative C increases the number of designated fishing sites from two to three, we anticipate that impacts associated with fishing under alternative C would be similar to those under alternative B. We would coordinate closely with VDGIF to keep informed about State fishing regulations, trends in fish populations, and disease outbreaks in fish to most effectively manage the fishing program at the refuge. This coordination would benefit the fishing program and user by keeping them informed and aware of current fisheries related news.

Beneficial impacts to public uses and access related to improving the existing canoe/kayak launch and designating three fishing sites would be similar to alternative B.

Expanding the nature trail and creating the wildlife drive would provide minor, direct, long-term benefits to those visitors who want to engage in wildlife observation, photography, environmental education, and interpretation on the refuge. This increase would potentially introduce a larger audience of people to hunting and fishing opportunities on the refuge and result in increased hunting and fishing participation. The impact would be negligible and indirect for the short term, but minor and direct in the long term.

Beneficial impacts to public use and access related to relaxing the refuge's permit requirements to visit the designated public use area would be similar to alternative B.

In addition to the expanded trail, we would also create a 2-mile wildlife drive under alternative C. We anticipate that the 2-mile wildlife drive would potentially attract up to 3,340 additional visitors to the refuge each year, with 10 visitors per day for the 334 days it would be open annually. These visitors would be able to gain an appreciation for the refuge from a leisurely 15-minute drive through the refuge, without having to leave their vehicle. This opportunity would provide access to nature for disabled persons, small children, and the elderly, further expanding the audience served. The impacts would be minor, direct, and long term.

Under alternative C, we would also create and install an interpretive sign at the northern terminus of Route 640 for visitors wanting to learn more about the refuge. Expanded programming, including up to four wildlife observation boat trips and up to three on-refuge and three off-refuge interpretive programs, would provide opportunities for the public to participate in non-consumptive wildlife-dependent uses. We anticipate these impacts would be negligible, direct, and long term.

Beneficial impacts to public uses and access related to the expansion of the nature trail and designating public use areas would be similar to alternative B.

### **Adverse Impacts**

#### *Habitat Protection and Management*

The forest management activity associated with transitioning the forest from being pine-dominated to transitional dry hardwood would potentially result in minor to moderate, direct, short-term impacts to hunters by periodically removing hunt locations where thinning and clear cutting is being actively performed. The thinning and clear cutting would remove vegetation that would take years to regrow. In thinned areas, few trees would remain that would be suitable to support a hunter tree stand. Hunters would be reallocated to remaining stands of pine, mature moist hardwoods, and floodplain forests. However, as we have more hunt stands now than are currently being used, this activity is not anticipated to have any lasting impact on the hunt because the hunters can hunt from other non-affected locations.

Increased pine thinning and selective clear cutting activity under alternative C would result in minor to moderate, direct, long-term impacts to wildlife observation, photography, environmental education, and interpretation by directing visitors away from locations while these activities are occurring.

#### *Public Use and Access*

Adverse impacts to public uses and access related to eliminating hunt locations from the designated public use area would be similar to alternative B.

Adverse impacts to public uses and access related to constructing infrastructure to support increased visitor use in the designated public use area would be similar to alternative B. Additionally, the construction of, or improvements to, the wildlife drive would possibly have impacts to the hunting programs from noise and refuge disturbance associated with the construction of these enhanced features, but impacts would be negligible, indirect and short term.

The hunting program would have minor, direct, short- and long-term impacts on non-hunting refuge visitors because we would close the wildlife drive to wildlife observation, photography, environmental education, and interpretation during hunt days. We will inform potential refuge visitors in advance via our website and on the refuge that the wildlife drive would be closed on these 31 hunt days.

The hunt program would have negligible to minor, indirect, short-term impacts on visitors engaged in wildlife observation, photography,

environmental education, and interpretation opportunities because hunt zones are located in other portions of the refuge and away from the approved public use area. Visitors may come into contact with hunters registering at the visitor contact station and along entrance roads. Areas of potential conflict would possibly occur in the spring during the 2-week turkey-only hunt. Visitor experiences may be lessened if they hear gunshots or see harvested animals on hunters vehicles departing the refuge. Actual or perceived impacts with hunting would only occur on a limited number of fall days, when non-consumptive public use is traditionally less. To mitigate any possible impact from hunting, on hunt days we would post signs at the entrance sign that indicate a hunt is going on. In advance of the hunts, we would also have information posted on our website and kiosk. On the 10 youth waterfowl hunter use days we would close a small portion of the trail (likely less than 1,000 feet) to minimize the potential for user conflicts and safety concerns. The impact of the partial trail closure would be negligible, direct, and short term.

#### 4.14 Socioeconomic Environment

As part of a refuge's CCP process, conducting an economic analysis provides a means of estimating how current management (no action alternative) and the proposed management activities would potentially affect the local economy. This type of analysis provides two critical pieces of information:

- 1) It illustrates a refuge's contribution to the local community; and
- 2) It can help in determining whether economic impacts are or are not a real concern in choosing among management alternatives.

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

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

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

##### 4.14.1 Socioeconomic Environment Impacts That Would not Vary by Alternative

###### Beneficial Impacts

Under each of the alternatives, the refuge would continue to pay revenue to Prince George County as part of the Refuge Revenue Sharing Program. As discussed in section 2.8.2, national wildlife refuges also contribute to local economies through shared revenue payments. Under the provisions of the

Refuge Revenue Sharing Act (the Act of June 15, 1935; 16 U.S.C. 715s), the Service pays an annual refuge revenue sharing payment at a rate set by Congress to municipalities that contain lands the FWS administers. James River NWR's revenue payments to Prince George County are listed in table 2-5 for 2005 to 2012. Our continued annual payments would result in direct, long-term impacts to Prince George County.

#### *Habitat Protection and Management*

In exchange for the removal of timber products from the refuge, our commercial forest management contractor compensates the Service in the form of materials or other services deemed necessary by the refuge for completing timber removal. These services or materials may include, but are not limited to any, sand, gravel, geotextile, dust abatement, culverts, labor, seedlings, fuel, or equipment costs. In recent years, the refuge has worked closely with the contractor to maintain and repair refuge roads in support of the commercial forest management activities. No money is exchanged between the commercial forest management contractor and the Service. The exchange of timber product removal for services or materials deemed necessary by the refuge provides a moderate, direct, local, long-term impact on the local economy.

#### *Public Use and Access*

The local economy would also continue to receive moderate, indirect, long-term impacts from expenditures related to deer hunting on the refuge. A 2001 study found that hunting generates \$25 billion (all figures are 2001 dollars) in retail sales in the U.S., \$17 billion in salaries and wages, and employs 575,000 Americans, as well as generates sales tax, state income tax and Federal income tax revenues for government agencies (International Association of Fish and Wildlife Agencies 2002). That same study found that, on average, each hunter spends approximately \$1,900 on hunting-related expenditures.

The 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation found that in Virginia, hunters 16 years and older expended \$877 million, of which nearly \$300 million was related to trip expenses; the remainder was for equipment and other expenses. On average, hunters were found to expend \$2,000 a year on hunting, or an average of \$30 a day (USDOI et al. 2013). The 2001 study found that in Virginia, deer hunting in particular results in \$337 million into local economies, and all hunting provides \$725 million (in 2001 dollars; International Association of Fish and Wildlife Agencies 2002). While all the alternatives include hunting, the degree of beneficial socioeconomic impact from hunting would vary by alternative.

#### **Adverse Impacts**

None identified.

### **4.14.2 Socioeconomic Environment Impacts of Alternative A**

#### **Beneficial Impacts**

Same as the impacts that do not vary among alternatives.

#### **Adverse Impacts**

Same as the impacts that do not vary among alternatives.

### 4.14.3 Socioeconomic Environment Impacts of Alternative B

#### Beneficial Impacts

Under alternative B, there is the potential for additional minor, indirect, long-term impacts to the local economy from staff would working more frequently at James River NWR to support the expanded forest management and visitor services, creating the opportunity for expenditures in the local economy. With limited Service resources available for additional monitoring of all habitats, partnerships would provide moderate, indirect, long-term impacts as it will help to supplement our information needs.

#### *Habitat Protection and Management*

Same as the impacts that do not vary among alternatives.

#### *Public Use and Access*

Of Virginia's residents and non-residents 16 years and older, 833,000 individuals fish, 432,000 individuals hunt, and 2.5 million individuals participate in wildlife-watching activities (USDOJ et al. 2013).

The increase in hunting opportunities and the addition of fishing on the refuge would bring additional visitor expenditures. The 2011 survey found that anglers 16 years and older spent \$1.1 billion on fishing-related expenses, of which \$469 million was trip-related, \$379 million was on equipment, and \$294 million was on other associated expenses, such as magazines and membership dues (USDOJ et al. 2013). Each angler spent on average \$1,237 each year, or \$45 per day.

The increased opportunities for visitors to participate in wildlife observation, photography, environmental education, and interpretation on the refuge would have minor to moderate, indirect, long-term impacts on the local economy. The 2011 survey found that wildlife watchers 16 years and older spent \$959 million on associated expenses, including \$300 million on trip-related expenses, \$493 million on equipment, and \$166 million on other expenses, such as magazines and membership dues (USDOJ et al. 2013). Each participant spent on average \$347 each year, or \$66 per day.

In addition to the economic benefits from individuals 16 years old or older, economic impact would result from expenditures on behalf of an additional 141,000 anglers, 354,000 resident hunters, and 324,000 residents wildlife-watching individuals 6 to 15 years old (USDOJ et al. 2013).

#### Adverse Impacts

Same as the impacts that do not vary among alternatives.

### 4.14.4 Socioeconomic Environment Impacts of Alternative C

#### Beneficial Impacts

Alternative C would potentially have an additional minor to moderate, indirect, short-term impacts to the local economy from a staffing increase and staff would be working more frequently at James River NWR to support the expanded forest management and visitor services, creating the opportunity for expenditures in the local economy. One full-time forester would be hired shared across the complex but would focus primarily on forest conversion efforts at James River NWR.

*Habitat Protection and Management*

Same as the impacts detailed under alternative B.

*Public Use and Access*

The increase in hunting opportunities and the addition of fishing on the refuge would bring additional visitor expenditures. These impacts would potentially be greater than those under alternative B, as we would be adding more hunting opportunities and opening up the refuge to one additional fishing location. Alternative C would also provide two more designated areas for interpretive access, which could attract more visitors to the refuge. Thus, under alternative C there is a potential for a slightly larger increase in visitor expenditures, resulting in moderate, indirect, long-term impacts to the local economy.

**Adverse Impacts**

Same as the impacts that do not vary among alternatives.

## **4.15 Cultural and Historic Resources**

### **4.15.1 Methodology for Assessment of Effect**

Because the CCP is an early stage of planning, and the appropriate level of cultural resource study is the archaeological overview (Goode et al. 2009) conducted in advance of the plan, evaluation of potential effects to cultural resources consists of identification of potential impacts on known archaeological sites that may be eligible for the National Register. The goal of the overview was to help the refuge locate activities and facilities out of the way of known cultural resources. We are required by both NEPA and NHPA to consider these resources during planning.

### **4.15.2 Cultural and Historic Resources Impacts That Would not Vary by Alternative**

Regardless of the alternative, the Service is responsible for managing and protecting cultural resources found on national wildlife refuges. The consequences of past, current, and proposed management on known cultural resources are the same across all alternatives. The archaeological overview (Goode et al. 2009) is an historic background study; the study included no fieldwork. The purpose of the impact analysis here is to identify areas of resource impact at an early stage and outline additional cultural resource work involved in further planning and implementation. The RHPO regularly reviews refuge proposals to conduct ground-disturbing activity or alterations to structures over 50 years old.

In consultation with the SHPO, the Service RHPO contracts or conducts archaeological and architectural surveys, evaluates sites, and mitigates impacts to resources it determines eligible for the National Register during the planning stages of any proposed projects. Any ground disturbing activities outlined in this plan will receive this further review and study. Two previously known sites on the refuge have already been determined eligible for the National Register and excluded from logging.

**Potential for Adverse Effects**

*Habitat Protection and Management*

Land-disturbing activities (e.g., clearing trees to establish logging decks,

conducting prescribed burns, installation of shoreline erosion controls, new facility construction, mechanical control of invasive plants) have the potential to adversely affect the cultural resources of the refuge.

We would implement recommendations outlined in the 2009 Archaeological Overview Study to minimize disturbance and prevent loss or degradation of cultural resources (Goode et al. 2009) and would coordinate with the RHPO, the SHPO, and other partners.

#### *Public Use and Access*

Public hunting and fishing opportunities are compatible with Native Indian values and practices, as well as consistent with the way this area was managed by indigenous peoples for thousands of years (Beacham 2014 personal communication).

Refuge visitors may inadvertently or even intentionally damage or disturb known or undiscovered cultural artifacts or historic properties. We would continue our vigilance in looking for this problem, use law enforcement where necessary, and continue our outreach and education efforts with local Virginia Indian Tribe and the NPS.

#### **Avoidance, Minimization, and Mitigation Strategies**

For compliance with Section 106 of the NHPA, the refuge staff would consult the RHPO during the early planning stages of proposed new actions when new ground-altering activities are proposed, evaluate existing facilities for National Register eligibility before altering, and require compliance with standard terms and conditions agreed to by refuge staff for forest management. We would provide a description and location of all projects, activities, routine maintenance, and operations that affect ground and structures, details on requests for compatible uses, and the range of alternatives considered. The RHPO would analyze those undertakings for their potential to affect historic and prehistoric sites, and consult with the SHPO and other parties as appropriate. We would notify the State and local government officials to identify concerns about the impacts of those undertakings.

### **4.15.3 Section 106 Summary for All Alternatives**

After applying the Advisory Council on Historic Preservation criteria of adverse effects, the Service concluded the implementation of any of our alternatives, including the no action alternative, would have the potential to result in an adverse effect on cultural resources that may be eligible for listing in the National Register. As described above, we would use management practices that avoid or resolve adverse effects on cultural resources, in accordance with the NHPA.

## **4.16 Cumulative Impacts**

According to the CEQ regulations on implementing NEPA (40 CFR 1508.7), a cumulative impact is an impact on the environment that 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 the other actions. Cumulative impacts can

result from individually minor but collectively significant actions taking place over time.

Our cumulative impacts assessment includes the actions of other agencies or organizations, if they are interrelated and influence the same environment. This analysis considers the interaction of activities at the refuge with other actions occurring adjacent to the refuge and over a larger state and regional spatial and temporal frame of reference.

#### **4.16.1 Natural Environment**

##### **Air Quality**

Air quality is generally good in the refuge vicinity, and the Richmond-Petersburg MSA met the attainment criteria for various air pollutants. None of the actions proposed in this CCP would result in rendering the MSA in nonattainment for those pollutants. Actions proposed in this CCP would be implemented in accordance with all applicable standards and practices for the protection of air quality, including following guidance provided to control dust and adherence to permit requirements when required for fuel-burning activities. Protection, restoration, and enhancement of native vegetation should generate beneficial impacts to air quality locally. These beneficial impacts will derive from the refuge's capacity to continue to filter out many air pollutants harmful to humans, wildlife, and the environment. We strive to reduce energy consumption with green infrastructure and products associated with refuge activities.

In addition, with the new Service goal of achieving carbon neutrality by 2020, the refuge will be undertaking aggressive efforts to reduce the energy use and carbon footprint of our buildings, facilities, vehicle fleet, and workforce to the maximum extent possible. We will also be exploring ways to offset our residual carbon footprint by integrating carbon sequestration awareness into conservation actions for wildlife and other habitat management activities to contribute a beneficial increment to air quality and humans within the Richmond-Petersburg MSA.

In summary, none of the actions we propose are expected to contribute to regional exceedances of Federal Clean Air Act air quality standards, and no Class I air quality areas would be affected.

##### **Water Quality**

All of the tidal areas in the refuge vicinity are classified as 303(d)-listed impaired waterways. None of the actions proposed in this CCP would alter that classification for any waterways in the refuge vicinity. Actions proposed in this CCP would be implemented in accordance with applicable standards to prevent further degradation of water quality in the refuge vicinity, including development of an approval of sediment and erosion control plan for land-disturbing activities.

Protection, restoration, and enhancement of native vegetation should generate beneficial impacts to water quality locally. These beneficial impacts will derive from the refuge's capacity to continue to filter out many water pollutants harmful to humans, wildlife, and the environment. We would develop our proposed shoreline management plan and refuge step-down plans to ensure conformity to the maximum extent practicable with Virginia's approved watershed implementation plans, special requirements for the

James River and Prince George County ordinances.

In accordance with EO 13514, Energy Independence and Security Act, and EO 13508, all Federal facilities are required to demonstrate leadership and commitment to controlling pollution, leveraging their expertise and resources to contribute significantly to improving the health of the Chesapeake Bay. We would enhance contact with State agencies to take all actions necessary to ensure that refuge activities avoid or minimize the potential for impacting receiving water quality. Water quality protection of wetlands and waterways of the Chesapeake Bay would be included in environmental education and interpretive programs offered both on and off the refuge. Our efforts would contribute to the overall beneficial impacts on water quality in the refuge vicinity, James River watershed, and Chesapeake Bay Estuary.

In summary, none of the activities proposed would contribute to adversely affecting local or regional hydrology and water quality. No proposed activities would violate Federal or State standards for contributing pollutants to water sources and all would comply with the Clean Water Act.

#### **Biological Integrity, Diversity, and Environmental Health**

None of our proposed management activities should adversely affect biological integrity, diversity, and environmental health either individually or when considered along with other activities on other ownerships in the region. In fact, our management actions strive to benefit and sustain these ecosystem components. The 1997 Refuge System Improvement Act states that in administering the Refuge System, the Service shall "...ensure that the biological integrity, diversity, and environmental health of the System are maintained." Biological integrity refers to the composition, structure, and function of habitats and communities or ecosystems and the natural processes that shape them.

Biological diversity is the variety of all living things. Environmental health encompasses the structure, function, and health of soil, water, air, and other abiotic elements. We based our proposed actions on consideration of other Federal, State, and conservation partner management plans after determining how the refuge could best contribute to the regional conservation landscape. In evaluating our impacts in this part of the CCP, we considered how we would affect perpetuating, maintaining, or restoring the biological integrity, diversity, and environmental health of the refuge.

Under both alternatives, we would work with partners across James River watershed to protect biological integrity through maintaining and restoring native habitats and ecological communities, and actively controlling invasive plants and animals. We would continue prevent the transportation of invasive plants elsewhere on the refuge by using best management practices, continuing to survey for invasive species, controlling existing populations, and educating the public about these invaders. For those refuge projects that have regional implications, we will serve as a demonstration area and work with our partners to establish a long-term monitoring program. Data and information will be shared to monitor the regional implications of climate change.

Wildlife species diversity would be maintained through native habitat protection and restoration, limiting public access into sensitive habitat areas,

and protecting and restoring habitats for federally listed species and species of conservation concern. Many of our conservation partners in the area are engaged in similar activities, and collectively, this has resulted in gains to certain wildlife populations. Coordinated management, research, and monitoring along the lower James River has benefitted populations of nesting bald eagles and wading birds, as well as breeding migratory landbirds such as the prothonotary warbler.

With regard to environmental health, we would ensure that refuge activities do not affect hydrological or soil processes and impact water quality in the lower James River. Refuge activities would be closely monitored that have the potential to impact soils. We would continue to work with partners to monitor water quality in the James River and document any concerns. We would also continue our work to restore the river escarpment habitat from erosion, which contributes sediment deposition to the James River and Chesapeake Bay systems.

When visitors come to the refuge, we would continue to promote and demonstrate best management practices and a conservation ethic in hopes that visitors will go back to their local communities and effect positive change.

### **Biological Resources**

Both of the alternatives would maintain or improve Service Trust resources and other native wildlife and plants in the region, although to varying degrees. As discussed in section 1.4, a wide variety of existing national, regional, and local plans and priority guidance documents directly influenced development of the biological resource management objectives in this draft CCP and EA. The combination of our management actions with other organization's actions could result in significant, beneficial cumulative impacts to biological resources by:

- Increasing the conservation and management of federally and State-listed threatened and endangered species and other species of concern and associated habitats, through protection and maintenance of ecologically important terrestrial and aquatic habitats.
- Using adaptive management and the best science available to manage and promote regionally important habitats and natural communities.
- Controlling invasive plants and animals that are not native to the area.
- Partnering with others to offer educational and interpretive programs that help refuge visitors understand issues related to the biological integrity and environmental health of the James River and the Chesapeake Bay, and foster their interest in stewardship of those resources.

Below we highlight particular Service activities that have the potential to cumulatively affect biological resources in the region.

#### *Native Plants and Wildlife*

Acquiring necessary information to monitor native wildlife habitats and species would add to the body of knowledge the Service would collect and share with other conservation partners, leading to a beneficial influence on

and improve of natural resource decisions, resulting in cumulative benefits on the biological environment over a broader landscape. In general, native habitat management would contribute beneficially to the biological environment as we expect to enhance the quality of habitats for native species of priority refuge wildlife of concern. Native plant management cumulatively benefits the biological environment by increasing and enhancing healthy soil biota, restoring and enhancing native plant resources, increasing resident wildlife populations of mammals, fish, reptiles, and amphibians, and enhancing invertebrate production to sustain and perpetuate migratory bird resources.

#### *Invasive Plants and Animals*

Certain biological resources that we would manage to control, prevent, or eliminate (i.e., invasive plants and animals) are not native components to habitats on the refuge. We do not consider the loss of these biotic elements to be an adverse impact. However, not controlling invasive on the refuge would contribute adversely to the local biological environment. Alternative B also has stronger biological monitoring components with increased efforts in surveying wildlife species and habitats and research coordination with others.

Controlling exotic and invasive plants may involve the use of chemical herbicides. The selective use of herbicides will be based upon an integrated pest management strategy that incorporates pest ecology, the size and distribution of the population, site-specific conditions, known efficacy under similar site conditions. Best management practices will reduce potential impacts to non-target species, sensitive habitats, and quality of surface and groundwater. Herbicide applications will be targeted to control discreet pest populations in localized areas. Herbicides applied on the refuge would be short-lived, resulting from environmental and microbial breakdown to less or non-hazardous degradation products.

#### **Public Use**

The land use immediately adjacent to the refuge is primarily agricultural and residential. As detailed under section 4.19.2, the anticipated population and employment increases by 2040 would likely result in an increased demand for public use may have cumulative impacts on the biological environment. The management objectives presented in the alternatives are our attempts to strike a feasible balance that ensures the refuge effectively protects the biological environment for the long term, while offering wildlife dependent recreational opportunities on the refuge.

Public deer hunting results in the direct loss of individual wildlife. However, not hunting deer on the refuge would contribute adversely to the local biological environment. We describe the site-specific impacts of the public hunting programs earlier in this chapter and in appendix B.

Cumulative impacts from research activities are not expected, but could occur if multiple research projects were occurring on the same resources at the same time or if the duration of the research was excessive. We describe the site-specific impacts of the biological research earlier in this chapter and in appendix B.

### **Bald Eagle Recovery**

The recovery of the bald eagle was accomplished due to two main factors: the banning of the pesticide DDT and habitat protection afforded by the ESA for nesting sites and important feeding and roost sites. The James River NWR was one of four refuges in the nation that was specifically created to provide management for the bald eagle. The James River NWR, a part of the Eastern Virginia Rivers NWR Complex, was established to protect bald eagle nesting sites and communal roost sites that are part of concentration areas along the Rappahannock and James rivers. These refuges within the Rappahannock River watershed and the James River watershed hold approximately half of Virginia's nesting population of bald eagles (72 FR 37351). Continuing to protect and promote bald eagle nesting, roosting, and foraging at James River NWR would contribute a moderate, direct, short- and long-term beneficial impacts on bald eagles in Virginia.

### **Climate Change**

Department of the Interior Secretarial Order 3226 (January 16, 2009) states that, "There is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making...This Order ensures that climate change impacts are taken into account in connection with Departmental planning and decision making." Additionally, it calls for the incorporation of climate change considerations into long-term planning documents, such as this CCP.

The Wildlife Society published a technical review report in 2004 titled "Global Climate Change and Wildlife in North America" (Inkley et al. 2004). The Wildlife Society report interprets results and details from such publications as the IPCC reports (1996 to 2002) and describes the potential impacts and implications on wildlife and habitats. It mentions that projecting the impacts of climate change is hugely complex because not only is it important to predict changing precipitation and temperature patterns, but more importantly, to predict their rate of change, as well as the exacerbated impacts of other stressors on the ecosystems. Those stressors include loss of wildlife habitat to urban sprawl and other developed land uses, pollution, ozone depletion, exotic species, disease, and other factors.

The impacts of climate change on populations and range distributions of wildlife are expected to be species specific and highly variable, with some species benefiting and others vulnerable to extirpation or extinction. Generally, the prediction in North America is that the ranges of habitats and wildlife will generally move upwards in elevation and northward as temperature rises (Inkley et al. 2004, Rodenhouse et al. in press). However, The Wildlife Society report emphasizes that developing precise predictions for local areas is not possible due to the scale and accuracy of current climate models, which is further confounded by the lack of information concerning species-level responses to ecosystem changes, their interactions with other species, and the impacts from other stressors in the environment.

To help meet the climate change challenge, the Service drafted a Climate Change Strategic Plan (USFWS 2009b). The plan employs three key strategies to address climate change: adaptation, mitigation, and engagement. The Association of Fish and Wildlife Agencies developed guidance for states as they update and implement their respective WAP (AFWA 2009). This publication "*Voluntary Guidance for States to*

*Incorporate Climate Change into State Wildlife Action Plans and Other Management Plans*” also includes strategies that will help conserve fish and wildlife species and their habitats and ecosystems as climate conditions change. The broad spatial and temporal scales associated with climate change suggest that management efforts that are coordinated on at least the regional scale will likely lead to greater success.

The Wildlife Society report provides 18 recommendations to assist land and resource managers in meeting the challenges of climate change when working to conserve wildlife resources (Inkley et al. 2004). Their position is that if land and resource managers collectively implement these recommendations, then cumulatively there would be a positive impact of addressing climate change. We discuss our actions relative to addressing some of these recommendations:

*Recognize Climate Change as a Factor in Wildlife Conservation*

The Service is taking a major role among Federal agencies in distributing and interpreting information on climate change. There is a dedicated website to this issue, which links to the Service’s recently released Strategic Plan for Climate Change (<http://www.fws.gov/home/climatechange>; accessed May 2011). The strategic plan includes two key elements: landscape conservation cooperatives and a National Fish and Wildlife Climate Adaptation Strategy; both elements bring together conservation partners to address climate change in a concerted effort. Strategies for adapting to and mitigating climate change are included in this CCP. Specific steps taken by the refuge will help reduce our greenhouse gas emissions, including using energy efficient equipment and vehicles where feasible; building and maintaining any structures using sustainable, green building technologies; conduct energy audits; and other strategies. In addition, we will rely on the habitat and species vulnerability assessments and other climate change research such as the SLAMM model already developed for James River NWR (Clough and Larson 2010).

*Manage for Diverse Conditions*

The habitat management actions described in chapter 3 are intended to promote healthy, functioning native habitats, to protect biological integrity, and maintain the resiliency within these systems to adapt to changing conditions. We would implement an adaptive management approach as new information becomes available.

*Do Not Rely Solely on Historical Weather and Species Data for Future Projections without Taking into Account Climate Change*

Historical climate, habitat, and wildlife conditions are less reliable predictors as climate changes. For example, there may be a need to adjust breeding bird survey dates if migratory birds are returning earlier to breed than occurred historically. Preliminary evidence from VCU’s monitoring of prothonotary nest boxes on the refuge indicates a trend that males are returning to the refuge earlier in the spring. We are aware of these implications and plan to build these considerations into our IMP and so that we can make adjustments accordingly. Under alternative B, we would incorporate climate change monitoring (such as phenology, timing of bird migrations, flooding regimes, and sea level rise) into our IMP.

*Expect Surprises, Including Extreme Events*

This CCP has incorporated extreme events (such as drought and increasing flood frequency) into future management strategies. We would continue to incorporate new information in future planning with the development of HMP, the IMP, and the VSP.

*Reduce Non-climate Stressors on the Ecosystem*

The objectives of our habitat management program are to maintain and enhance the biological integrity, diversity, and health of refuge lands. Objectives to promote healthy forests and to manage other refuge habitats for native vegetation would help maintain resilience in the face of climate change.

*Maintain Healthy, Connected, Genetically Diverse Populations*

Small isolated populations are more prone to extirpations than larger, healthy, more widespread populations. Larger tracts of protected land facilitate more robust species populations and can offer better habitat quality in core areas. We would continue to work with our many conservation partners at the State and regional levels to support and complement restoration and protection efforts around the James River and in the Chesapeake Bay watershed.

*Translocate Individuals*

It may sometimes be necessary to physically move wildlife from one area to another to maintain species viability. However, this tool has potential consequences and should only be used in severely limited circumstances as a conservation strategy. In the case of Atlantic sturgeon and American shad, the Service supports efforts to bolster population levels through egg-taking, hatchery rearing, and stocking to establish breeding populations in the wild. The Service would support the translocation of other species to establish or restore populations on or near the refuge, if feasible, and evidence would indicate that it would not affect the ecological integrity of the refuge.

*Protect Coastal Wetlands and Accommodate Sea Level Rise*

We would continue to work with our conservation partners around the James River and Chesapeake Bay to protect tidal habitats. The tidal freshwater marsh and swamp of the refuge would be inundated by projected sea level rise due to their elevation. Because of this, the refuge may serve as an important indicator for the impacts of climate on plants and animals. We would use the information gathered from our monitoring programs to adapt management to reduce the threat and maintain critical natural resources in the James River and Chesapeake Bay.

*Reduce Likelihood of Catastrophic Events Affecting Populations*

Increased intensity of severe weather can put wildlife at risk. While the severe weather cannot be controlled, it may be possible to minimize the impacts by supporting multiple, widely spaced populations to offset losses. We can help reduce this risk by managing for diverse conditions; biological integrity, diversity, and environmental health; and connected genetically diverse populations. Under both alternatives, the refuge would work with regional partners to conserve and manage sufficient large patches of high quality habitat that are connected by suitable travel corridors. This is a main focus of the Service's newly formed North Atlantic LCC.

*Prevent and Control Invasive Species*

Climate change may increase opportunities for invasive species to spread because of their adaptability to disturbance. Invasive species control will be essential, including extensive monitoring and control to preclude larger impacts. Invasive species control is a major initiative within the Service. The Northeast Region, in particular, has taken a very active stand. In chapter 2, we describe the current extent of invasive species on the refuge and in chapter 3, we include strategies common to both alternatives for controlling existing and future invasive plant infestations. We also describe monitoring and inventorying strategies to protect against any new infestations.

*Account for Known Climatic Conditions*

Monitoring key resources through predictable short-term periodic weather phenomenon, such as El Niño, can aid in future management efforts. We plan to develop a monitoring program that would help us evaluate our hypotheses, assumptions, and successes in achieving objectives, as well as help us make future management decisions. Any restoration activities or proactive habitat management actions would be carefully planned and their effectiveness monitored and documented so we can use this information in future management decisions.

*Select and Manage Conservation Areas Appropriately*

The establishment of refuges, parks, and reserves is used as a conservation strategy to try to minimize the decline of wildlife and habitats in North America. Decisions on locating future conservation areas should take into account potential climate change and variability. For example, it is suggested that decisions on new acquisitions consider the anticipated northward migrations of many species, or the northern portion of species ranges. Managers of existing conservation lands should consider climate change in future planning. We would continue to work with our conservation partners in the James River and Chesapeake Bay watersheds to identify and protect areas that maintain connectivity and biological integrity in the face of climate change and other stressors.

*Ensure Ecosystem Processes*

Managers may need to enhance or replace diminished or lost ecosystem processes. Manually dispersing seed, reintroducing pollinators, treating invasive plants and pests, are examples used. Our habitat goals and associated objectives include an emphasis on maintaining the ecological integrity of intact habitats on the refuge, enhancing habitats through planting diverse native species, allowing natural succession to occur within one of the major habitats, and controlling invasive plant species. Alternative B would maximize this recommendation by protecting and restoring natural processes in most habitats on the refuge.

*Use Monitoring and Adaptive Management*

Managers should monitor climate and its impacts on wildlife and their habitats and use this information to adjust management techniques and strategies. Given the uncertainty with climate change and its impacts on the environment, relying on traditional methods of management may become less effective. We agree that an effective and well-planned monitoring program, coupled with an adaptive management approach, will be essential to dealing with the future uncertainty of climate change. We have built both aspects into our CCP. We would develop a detailed step-down IMP designed to test our

assumptions and management effectiveness in light of ongoing changes. With that information in hand, we would either adapt our management techniques, or reevaluate or refine our objectives as needed.

#### **4.16.2 Human Environment**

##### **Public Use and Access**

Allowing public use is part of the Service mandate. Each of the alternatives currently allow public access to the refuge. However, alternatives B and C would allow for a greater diversity and abundance of opportunities. Both alternatives B and C would reduce and eliminate the reservation requirement to visit the refuge once visitor support facilities were enhanced. Therefore, with regard to public use and access, these two alternatives both provide long-term beneficial impacts by allowing more and new audiences to experience the refuge. As an urban refuge, we would increase the potential for those who may not have access to nature to experience and gain an appreciation for wildlife.

##### **Socioeconomic Resources**

None of the actions proposed in this CCP would require Prince George County to reclassify land use designations for refuge lands. However, we would work with the County to ensure that all refuge lands are accurately represented as public lands in their next Comprehensive Plan. We expect beneficial impacts on the socioeconomic environment would result from maintaining and enhancing wildlife populations, improving native wildlife habitats, and protecting the biological integrity, diversity, and environmental health of refuge lands, which sustain and provide numerous ecosystem services that benefit wildlife and humans. We anticipate contributing beneficially to the growing residential community and visiting public's appreciation for natural areas and understanding of our collective stewardship responsibilities to protect areas of notable natural and cultural importance.

The human population of Prince George County is expected to grow 14 percent by 2020, and the employment rate is expected to grow 14 percent for the Crater Area, an area of interest that includes southern Chesterfield County eastward to include Prince George and Surry Counties and southward to include Dinwiddie, Sussex, and Greeneville Counties (Virginia Employment Commission 2013). Population growth in Prince George County is expected to slow from a 7.9 percent increase in 2010 to a 3.7 percent in 2040, while modest population increases are predicted to occur in Hopewell and Petersburg (above 4 percent and almost 2 percent, respectively) each decade through 2040 and Chesterfield County experiences a constant population growth hovering around 21 percent each decade through 2040 ([http://www.craterpdc.org/data/projected\\_population.htm](http://www.craterpdc.org/data/projected_population.htm); accessed November 2013).

The human population and employment are expected to grow 45 percent and 46 percent, respectively, by 2035 in the Ruffin Mill area. The Ruffin Mill area is currently a rural and suburban area, located along the I-295 corridor and west of the refuge ([http://www.richmondregional.org/Publications/Reports\\_and\\_Documents/Planning/SocioEconomic/Socioeconomic\\_Data\\_2008\\_2035/2008\\_to\\_2035\\_Socioeconomic\\_Analysis\\_Report.pdf](http://www.richmondregional.org/Publications/Reports_and_Documents/Planning/SocioEconomic/Socioeconomic_Data_2008_2035/2008_to_2035_Socioeconomic_Analysis_Report.pdf); accessed November 2013). The recently

completed Meadowville Technology Park industrial complex and its I-295 interchange will support the expected population and employment growth. The master plan for Meadowville Technology Park includes biotech/pharmaceutical facilities, research and development centers, and semiconductor manufacturing (<http://meadowville.com/meadowville-development-sites/>; accessed May 2014). We anticipate this population increase would result in an increased interest in, and use of, existing public lands and recreational areas in the vicinity, including Henricus Historical Park, Dutch Gap Conservation Area, and Presquile NWR. A portion of this increased recreational demand may be accommodated by the Captain John Smith Chesapeake NHT experiences on land and water.

We anticipate increased motorized boating in deeper waters adjacent to the refuge and increased boating on Powell Creek. Through our partnership with the NPS and JRA to offer environmental education and interpretive programs associated with the Captain John Smith Chesapeake NHT on Powell Creek (NPS 2011). Although the refuge is not currently within any focus area, Powell Creek does offer visitors a glimpse into the past where sights and sounds of the modern world are minimal or completely absent. Interpretive and educational programming on and about the refuge in the Captain John Smith Chesapeake NHT would contribute toward public understanding and appreciation for the natural environment that American Indians and European settlers would have experienced in the early 1600s. It is essential that we continue to collaborate with the NPS on implementation of the Captain John Smith Chesapeake NHT to ensure the protection of refuge resources for their enjoyment by future generations.

Our working relationships with existing partners and new partners would improve in terms of responsiveness to inquiries and speed of joint projects under alternative B. That improvement mainly would result from the increased staffing in key areas such as biology, public use, and maintenance. The overall coordination and communication with the public would improve under alternative B because a new staff position would deal with public use and public information.

Our working relationships with existing partners and new partners would improve in terms of responsiveness to inquiries and speed of joint projects under alternative B. That improvement mainly would result from the increased staffing in key areas such as biology, public use, and maintenance. The overall coordination and communication with the public would improve under alternative B because a new staff position would deal with public use and public information.

An increased emphasis on environmental education in alternative B would foster greater understanding and appreciation of the refuge's natural and cultural resources at the local and regional levels, and potentially lead to increased support and funding to support for partner-sponsored environmental education and interpretive programming. Ultimately, these efforts would benefit fish and wildlife resources on the refuge in the long term. The increased outreach of these alternatives could also positively affect land use decisions outside the refuge by local governments and private landowners, and lead to increased fish and wildlife populations over a broader area.

### **Cultural Resources**

Overall, each of the three alternatives would contribute beneficially toward protection of cultural resources on the refuge, although to varying degrees.

Under alternative B:

- We expect beneficial impacts of implementing recommendations provided in the archaeological overview (Goode et al. 2009) for James River NWR would complement efforts by the SHPO and RHPO to protect cultural resources throughout the State and the Refuge System.
- Our proactive approach to Section 110 compliance would contribute an additional, noticeable increment to the overall effort by the SHPO and RHPO to protect cultural resources on refuges. James River NWR would become one of the few refuges in the Service's Northeast Region taking a proactive approach toward cultural resource protection.
- We expect beneficial impacts to derive from improved partnerships for the interpretation of the refuge's cultural landscape within the context of the Captain John Smith Chesapeake NHT. In partnership with the NPS, JRA, and others, we would offer opportunities for the public to experience these landscapes while instilling an ethic for cultural resource protection and stewardship to ensure their enjoyment by future generations.

## **4.17 Relationship between Short-term Uses of the Human Environment and Enhancement of Long-term Productivity**

In this section we examined the relationship between local, short-term uses of the human environment and maintaining the long-term productivity of the environment. "Long term" captures impacts that would extend beyond the 15-year period of this CCP.

Many soil types on the refuge are soils associated with designated prime farmlands or farmland of statewide importance ([http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/stelprdb1187178.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1187178.pdf); accessed November 2013), and 72.4 percent of the refuge lands have soils in these categories. Soil properties are only one of several criteria that are necessary for prime or unique farmland designations. Other criteria for designating prime or unique farmland include growing season and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming methods. Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. In some areas, land that does not meet the criteria for prime or unique farmland is considered to be farmland of statewide importance for the production of food, feed, fiber, forage, and oilseed crops. The criteria for defining and delineating farmland of statewide importance are determined by the appropriate state agencies. Generally, this land includes areas of soils that nearly meet the requirements for prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some areas may

produce as high a yield as prime farmland if conditions are favorable. Farmland of statewide importance may include tracts of land that have been designated for agriculture by state law.

Under each of the alternatives, our primary aim is to maintain or enhance the long-term productivity and sustainability of natural resources on the refuge, in Virginia, and in the mid-Atlantic ecoregion. The alternatives strive to provide habitat for bald eagles and other species of concern and the habitats that they depend on. The key difference among each of the alternatives with the greatest potential to impact long-term productivity is the desired future condition for the pine-dominated forest type.

We predict that none of the alternatives would adversely impact the refuge's prime farmland or farmlands of Statewide importance. Our habitat management actions would contribute positively in maintaining and enhancing the long-term productivity of the refuge's natural resources with sustainable beneficial cumulative and long-term benefits to the environment surrounding the refuge with minimal inconvenience or loss of opportunity for the American public.

#### **4.18 Unavoidable Adverse Impacts**

Unavoidable adverse impacts are the impacts of those actions that could cause harm to the human environment and cannot be avoided, even with mitigation measures. Each of the alternatives would result in some minor, localized, unavoidable adverse impacts. For example, any thinning, prescribed burns, mowing, or control of invasive species would produce minor, short-term, localized adverse impacts. However, none of those impacts would rise to a considerable level, and in the long term they would have beneficial impacts. Furthermore, we would mitigate all those impacts with best management practices, resulting in none of the alternatives causing significant, unavoidable cumulative impacts.

Some habitat types on the refuge would be adversely affected. The adverse impacts generally are short term and more than offset by the long-term benefits to fish and wildlife, habitats, biological integrity and diversity, and environmental health.

Proposed public uses may have unavoidable adverse impacts on vegetation, soils, and wildlife. However, we minimize these impacts to the extent possible by allowing only pedestrian use on designated trails (except during hunting), limiting access to less sensitive areas, and minimizing impacts through best management practices in trail use. Alternatives B or C would have adverse impacts to a certain segment of the public that does not desire any change in current habitat management or public use programs. We believe we have sought a fair balance in minimizing and mitigating adverse impacts while optimizing wildlife conservation and providing excellent public use opportunities.

## 4.19 Potential Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be reversed except perhaps in the extreme long term or under unpredictable circumstances. An example of an irreversible commitment is an action that contributes to a species' extinction. Once extinct, it can never be replaced. No irreversible commitments of resources are predicted as a result of management activities on James River NWR.

In comparison, irretrievable commitments of resources are those that can be reversed, given sufficient time and resources, but represent a loss in production or use for a period of time. In our professional judgment there are only a few actions proposed that could be considered irretrievable and primarily relate to shoreline stabilization and construction of new facilities to support refuge operations and public use that are listed in appendix D. They are considered irretrievable because, in the future, any facility we construct could potentially be dismantled and the site restored; however, while standing, they represent a loss in habitat productivity.

In our professional judgment, the overall local and regional benefits to the human environment outweigh the loss of productivity on fewer than three refuge acres.

## 4.20 Energy Efficiency

President Obama signed EO 13514, "Federal Leadership in Environmental, Energy, and Economic Performance" on October 5, 2009, to establish an integrated strategy towards sustainability in the Federal government and making reductions in greenhouse gas emissions a priority for Federal agencies. In 2010, President Obama announced two targets for the Federal government to reduce its greenhouse gas emissions. The first target is a reduction in direct greenhouse gas emissions, such as those from fuels and building energy use, by 28 percent by 2020. The second target is a reduction in indirect greenhouse gas emissions, such as those from employee business travel and employee commuting, by 13 percent by 2020. The Federal government estimates that by meeting these two goals, by 2020 they could save up to \$11 billion in energy costs and eliminate the equivalent of 235 million barrels of oil from their activities. As of 2010, the Federal government had reduced greenhouse gas pollution by 2.5 million metric tons of carbon dioxide emissions compared to its 2008 baseline and is on track to meet their 2020 Federal greenhouse gas pollution reduction targets (<http://sustainability.performance.gov>; accessed November 2013).

To demonstrate proactive leadership among government agencies, the Service adopted a commitment to become carbon neutral by 2020 in *Rising to the Urgent Challenge: Strategic Plan for Responding to Accelerating Climate Change* (referred to as the *Strategic Plan*; USFWS 2009b). The Service implements strategies to achieve the goal of carbon neutrality through policy outlined in 565 FW 1.

Outlined in 565 FW 1 are three categories where Service activities should consider approaches that are sustainable and work towards the goal of carbon neutrality: minimizing energy use, better planning, and work practices.

Under all alternatives, we would minimize energy use to the maximum extent practicable by:

- Moving toward eliminating the use of fossil fuels.
- Increasing the use of renewable energy.
- Using high performance sustainable building design, construction, operation and management, maintenance, and deconstruction.
- Managing electronic assets in an environmentally sound and energy efficient manner throughout their life cycle.
- Improving efficiencies in our fleet and transportation management.

By improving our planning, we aim to:

- Reduce or eliminate the quantity of toxic and hazardous chemicals and materials we acquire, generate, use, and dispose of.
- Participate in regional and local integrated planning.
- Reduce pollution.
- Implement formal Environmental Management Systems at all appropriate organizational levels.
- Increase the diversion of solid waste and maintaining cost-effective waste prevention and recycling programs in Service facilities through our “James River Excess to Asset” program with assistance from refuge partners and volunteers.
- Improving wastewater management.
- Reduce water consumption.

By improving our work practices, we would continue to:

- Advance sustainable acquisition of goods and services.
- Implement sustainable landscaping practices.
- Promote workforce practices that minimize greenhouse gas emissions.
- Ensure we have environmental leaders in our organization.
- Ensure our concession and commercial visitor service operators conduct sound environmental management.

In our professional judgment, the overall impact of these practices to the local and regional environment would be beneficial.

## 4.21 Environmental Justice

President Clinton signed EO No. 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” on February 11, 1994, to focus Federal attention on the environmental and human health conditions of minority and low-income populations, with the goal of achieving environmental protection for all communities.

The order directs Federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high, adverse human health or environmental impacts of their programs, policies, and activities on minority and low-income populations. The order is also intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment, and to provide minority and low-income community’s access to public information and participation in matters relating to human health or the environment.

The U.S. EPA Office of Environmental Justice defines it as follows:

*Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental law, regulations, and policies. EPA has this goal for all communities and persons across this Nation. It will be achieved when everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decisionmaking process to have a healthy environment in which to live, learn, and work.*  
(<http://www.epa.gov/environmentaljustice>; accessed September 2013).

To facilitate this, Federal agencies should also consider if a significant portion of the affected community is linguistically isolated and, as warranted, provide translated documents and other appropriate outreach materials.

As table 2.4 indicates, minority, low-income, and linguistically isolated populations are present in the vicinity of James River NWR, primarily in the cities of Richmond, Hopewell, and Petersburg. We believe, based on our socioeconomic and environmental consequences analysis, that none of our proposed alternatives would place a disproportionately high, adverse environmental, economic, social, or health impacts on minority or low-income persons because:

- The CCP and EA Planning Team actively solicited public participation as part of the planning process and gave equal consideration to all input from persons regardless of age, race, income status, or other socioeconomic or demographic factors.
- Implementation of the proposed alternatives would not result in any identifiable adverse human health impacts. Therefore, there would be no direct or indirect adverse impacts on any minority or low-income population.
- The impacts associated with implementation of the proposed alternatives would not disproportionately affect any minority or low-income population or community.

- Any impacts to the socioeconomic environment would not appreciably alter the physical and social structure of the nearby communities.

Beneficial impacts include maintaining natural vegetation that improves air and water quality through filtering, paying refuge revenue sharing payments to Prince George County, and providing enhanced public use opportunities under the alternative B, the Service preferred alternative.

Before we make any decisions to make major changes in habitat management or the environment we always inform all of our publics, equally, and our programs and facilities are open to all who are willing to adhere to the established refuge rules and regulations. We do not discriminate in our responses for technical or practical information on conservation issues or when providing technical assistance in managing private lands. Additionally, all refuge uses proposed under the alternatives would be open to all members of the public. The Service is also an equal opportunity employer.

## **4.22 Summary of Environmental Consequences**

The following table 4.2 summarizes the benefits and adverse impacts we described above in chapter 4 for specific resources or programs proposed for James River NWR under each of the alternatives. For our discussion on cumulative impacts, the relationship between short-term uses of the human environment and enhancement of long-term productivity, unavoidable adverse impacts, potential irreversible and irretrievable commitments of resources, and environmental justice, please refer to the chapter 4 narratives above.

**Table 4.2 Summary of Environmental Consequences**

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
<b>Air Quality</b>	<p><b>Beneficial Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Each of the management alternatives would retain 4,324 acres within the refuge boundary as a primarily forested habitat, which would result in negligible, long-term impacts with regard to carbon sequestration, air filtration, and heat island mitigation.</li> <li>With the exception only of the pine-dominated forest and non-forested upland, all management activities would continue to result in the same impacts for all the habitats present on the refuge. We would not create any new permanent sources of emissions by implementing any of the alternatives.</li> <li>Federal Clean Air Act air quality standards would not be exceeded.</li> <li>No Class I air quality areas would be affected.</li> <li>No major stationary or mobile sources of air pollution are present on Service-owned lands nor would any be created.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>No beneficial impacts that do not vary by alternative.</li> </ul> <p><b>Adverse Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Each of the management alternatives would result in negligible, short-term impacts from prescribed fire activities conducted to control invasive plants and manage the forest communities. We would continue to follow prescribed burn plans to minimize impacts on surrounding areas.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Localized increases in emissions from visitor vehicles would have negligible, direct, short-term impacts.</li> </ul>		
	<p><b>Beneficial Impacts</b></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul>	<p><b>Beneficial Impacts</b></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Increased thinning would potentially result in moderate, indirect, long-term impacts with regard to reduced carbon sequestration benefits.</li> <li>More frequent prescribed burns annually would have minor, direct, short-term impacts.</li> <li>Slight increase in vehicular traffic on the refuge from increase in staff numbers and times for forest management would have negligible, direct, short-term impacts.</li> <li>Increase in acreage of non-forested upland by approximately 2 acres would have negligible, direct, short-term impacts from annual mowing. (air emissions from mowing equipment not distinguishable from alternative A.)</li> </ul>	<p><b>Beneficial Impacts</b></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Selective clear cutting and thinning would potentially result in moderate, indirect, long-term impacts with regard to reduced carbon sequestration benefits.</li> <li>Prescribed burns annually would have negligible, indirect, and short-term impacts, as they would be performed on a less frequent basis than under current management.</li> <li>Slight increase in vehicular traffic on the refuge would have impacts same as those under alternative B.</li> <li>Increase in acreage of non-forested upland would have impacts same as those under alternative B.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts detailed under alternative B.</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
Air Quality (cont.)		<p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Creating parking for the canoe/kayak launch would require limited equipment that would have negligible, direct, short-term impacts during construction. Additional NEPA review for proposed construction projects would analyze air quality impacts.</li> <li>• Vehicle emissions from contractor performing work would have negligible, direct, short-term impacts during construction.</li> <li>• Increased public use opportunities would potentially increase the vehicular traffic on the refuge, resulting in minor, direct, long-term impacts from vehicle emissions.</li> <li>• Increased staff presence as a result of increased visitation and public access infrastructure would involve one or two vehicles traveling to and parking at the refuge on a weekly basis, resulting in minor, direct, long-term impacts.</li> </ul>	
Water Resources	<p><b>Beneficial Impacts That Would Not Vary by Alternative</b></p> <ul style="list-style-type: none"> <li>• None of our proposed management activities should adversely affect local or regional hydrology and water quality. None would violate Federal or State standards for contributing pollutants to water sources; all would comply with the Clean Water Act.</li> </ul> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Implementing best management practices during thinning, prescribed burning, and construction activities would result in moderate, direct, long-term impacts to refuge water resources because we would actively be preventing soil and chemicals from entering into waterways.</li> <li>• Informal monitoring of the erosional bluff habitat by refuge staff would provide minor, indirect, short-term impacts to erosional bluff habitat because we would be able to keep informed on the condition of the habitat and identify any noteworthy changes.</li> </ul> <p><u>Public Use and Access</u></p> <p>None identified.</p> <p><b>Adverse Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Use of heavy equipment to complete tree removal activities in the pine-dominated forest habitat and construction of refuge infrastructure and facilities would result in minor, indirect, short-term impacts to water resources because construction and some tree removal activities would require land disturbance to occur.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• No impacts that would not vary among alternatives.</li> </ul>		

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
<p><b>Water Resources (cont.)</b></p>	<p><b>Beneficial Impacts</b>  <u>Habitat Protection and Management</u>  <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <u>Public Use and Access</u>  <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <b>Adverse Impacts</b>  <u>Habitat Protection and Management</u>  <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <u>Public Use and Access</u>  <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> </p>	<p><b>Beneficial Impacts</b>  <u>Habitat Protection and Management</u>  <ul style="list-style-type: none"> <li>Monitoring shoreline conditions and bank loss within the refuge would provide minor, indirect, short-term impacts to water resources within the refuge by providing information to guide selection of site-appropriate shoreline stabilization technique and planting options.</li> </ul> <u>Public Use and Access</u>  <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <b>Adverse Impacts</b>  <u>Habitat Protection and Management</u>  <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <u>Public Use and Access</u>  <ul style="list-style-type: none"> <li>Development of public use facilities and infrastructure (improving the canoe/kayak launch, installing a wildlife observation platform and fishing platform, enhancing the nature trail, and improving the parking) would result in minor, direct, short-term impacts to water quality of local waterways because the construction of the facilities would require land disturbance and the operation of the facilities would increase impervious surfaces and water use within the refuge.</li> <li>Improving the canoe/kayak launch, which also includes access to fishing, would result in negligible, direct, short-term impacts because boaters may stir up the sediment on the bottom of Powell Creek or introduce pollutants into the waterways.</li> <li>Re-suspension of bottom sediments would result in increased turbidity and decreased water clarity, resulting in negligible impacts to SAV in Powell Creek.</li> </ul> </p>	<p><b>Beneficial Impacts</b>  <u>Habitat Protection and Management</u>  <ul style="list-style-type: none"> <li>Same as the impacts detailed under alternative B.</li> </ul> <u>Public Use and Access</u>  <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <b>Adverse Impacts</b>  <u>Habitat Protection and Management</u>  <ul style="list-style-type: none"> <li>Converting pine-dominated forest to a transitional dry hardwood forest would result in minor to moderate, indirect, short-term impacts to water resources from increase in amount and frequency of tree removal activities.</li> <li>Controlling the pine seed bank while converting the pine-dominated forest to a transitional dry hardwood forest through increase amount and frequency of herbicide application would result in minor to moderate, direct, short-term impacts to water resources.</li> </ul> <u>Public Use and Access</u>  <ul style="list-style-type: none"> <li>Same as the impacts detailed under alternative B.</li> </ul> </p>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
Soils	<p><b>Beneficial Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Maintaining natural land cover throughout refuge habitats would continue to provide moderate, direct, long-term impacts to the refuge's soils because this condition would continue to help prevent erosion and keep existing soil resources in place.</li> <li>Continuing to maintain native tree species along the refuge shoreline of erosional bluff would provide minor, direct, long-term impacts to soils of the refuge because trees would help prevent and reduce erosion within a habitat that has inherently unstable soils due to soil composition, slope, and direct influence of the James River.</li> </ul> <p><u>Public Use and Access</u></p> <p>None identified.</p> <p><b>Adverse Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Exposed bare soil from upland locations, such as the pine-dominated forest, during forest management activities would have a negligible, direct, short-term impact on refuge soils because the soil may become airborne and form dust or be transported to other locations on the refuge or into waterways through erosion.</li> <li>Thinning and selective clear cutting activities would result in minor, direct, short- and long-term impacts to refuge soils through nutrient release, specifically nitrogen and carbon loss to the atmosphere.</li> <li>Prescribed burning would result in negligible to minor, direct, short-term impacts to refuge soils because prescribed burning results in an immediate, temporary reduction of understory and ground vegetation, which helps to protect soils from wind and water erosion.</li> <li>Maintenance activities associated with existing infrastructure and facilities, including mowing and the construction of approved planned RONS and SAMMS projects, would result in negligible, direct, short-term impacts to refuge soils.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Hunting opportunities would result in negligible, direct, long-term impacts to soils because hunters would be dispersed through a relatively large portion of the refuge.</li> </ul>		
	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Constructing the trail improvements and extending the existing 0.5-mile nature trail to a 3-mile nature trail would result in minor, direct, short-term impacts to soils along the trail corridor, from the land disturbance associated with construction.</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Converting pine-dominated forest to transitional dry hardwood forest would result in minor, direct, long-term impacts to soils because once the conversion is complete, management activities would result in minimal soil disturbance.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Forest management activities in the conversion of the pine-dominated forest to the transitional dry hardwood forest would result in minor, direct, short-term impacts to soils because for specific burn units the forest thinning activities would</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
		<ul style="list-style-type: none"> <li>Maintenance and use of the trail</li> </ul>	
<b>Soils (cont.)</b>		<p>by the public would result in minor, direct, long-term impacts from foot traffic because the trail would be maintained indefinitely.</p> <ul style="list-style-type: none"> <li>Increased public use activity, including expanded hunting opportunities, on the refuge would result in negligible, direct, long-term impacts to soils adjacent to designed public use areas such as trails and parking areas.</li> </ul>	<ul style="list-style-type: none"> <li>require more equipment and land disturbance to achieve the desired condition.</li> <li>Forest management activities in the conversion of the pine-dominated forest to the transitional dry hardwood forest would result in minor, direct, short-term impacts to soils because more herbicide applications would be required to suppress pine regeneration, and herbicides may accumulate in the forest litter and soils.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Constructing the trail improvements and extending the nature trail would result in minor, direct, short-term impacts to soils along the trail corridor, from the land disturbance associated with construction.</li> <li>Maintenance and use of the trail by the public would result in minor, direct, long-term impacts from foot traffic because the trail would be maintained indefinitely.</li> <li>Increased public use activity, including expanded hunting opportunities, on the refuge would result in minor, direct, long-term impacts to soils adjacent to designed public use areas such as trails and parking areas.</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
Vegetation – Forested Habitats	<b>Beneficial Impacts That Would Not Vary by Alternative</b>		
	<p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>By continuing to maintain all forested habitats so that they provide roosting and nesting for bald eagles, the forest habitats would continue to have moderate, direct, long-term impacts because managing for bald eagles is good for overall forest integrity.</li> <li>We would continue to minimize management activities in the mature moist hardwood forest and floodplain forest. Within the floodplain forest we would not conduct any thinning, which would help to minimize the opportunity for invasive plant species to become established because soil disturbance and introduction opportunities would be minimized.</li> </ul> <p><u>Public Use and Access</u> None identified.</p>		
	<p><b>Adverse Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Cultural resource protection requirements would result in minor, direct, short- and long-term impacts to refuge vegetation by affecting how long it may take the refuge to achieve its forest management goal of protecting, enhancing, and restoring the ecological integrity of inner coastal plain forest ecosystems of the lower James River to support native wildlife and plant communities and to ensure those ecosystems are resilient in anticipation of climate change.</li> </ul> <p><u>Public Use and Access</u> None identified.</p>		
<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Thinning and prescribed burning activities in the pine-dominated forest would result in minor, direct, long-term impacts to the overall health of the refuge’s pine-dominated forest by reducing the threat of a potential pine beetle infestation.</li> <li>Reducing fuel loads and the potential for catastrophic wildfires in the pine-dominated forest would result in moderate, direct, long-term impacts to refuge vegetation by making the pine-dominated forest healthier, more wildfire-resistant.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Protecting hardwood tree species during thinning and prescribed burning activities in the pine-dominated forest would continue to result in minor, indirect, long-</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Reducing the tree density in the pine-dominated forest to 200 trees per acre within the life of the CCP and to between 80 to 100 trees per acre over the next 30 years to achieve a pine savanna density would provide moderate, indirect, long-term impacts because healthier trees and an herbaceous understory would result from management actions.</li> <li>Increased thinning and prescribed burning activities in the pine-dominated forest would result in minor to moderate, direct, long-term impacts to refuge vegetation with respect to managing invasive species because the desired tree density of the pine savanna forest would more significantly reduce the threat of a disease outbreak or pest infestation.</li> <li>Monitoring habitat health through the habitat requirements of the priority refuge species for the pine-dominated, mature moist hardwood, and floodplain forests would provide minor, indirect,</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Thinning and prescribed burning to convert the pine-dominated forest to a transitional dry hardwood forest would result in moderate, direct, short- and long-term impacts to refuge vegetation because a young mix of hardwood species and pine trees would be released from direct competition with the overstocked pine-dominated forest.</li> <li>Converting the pine-dominated forest to a transitional dry hardwood forest would provide moderate to major, direct, short-term impacts to refuge vegetation because early successional plant and wildlife species would be abundant following tree removal and the threat of pine beetle infestations would be reduced.</li> <li>Converting the pine-dominated forest to a transitional dry hardwood forest would provide minor, indirect, long-term benefits to moist hardwood forest because the conversion would increase the amount of contiguous hardwood</li> </ul>	

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
<p><b>Vegetation – Forested Habitats (cont.)</b></p>	<p>term impacts to the refuge’s pine-dominated forest.</p> <ul style="list-style-type: none"> <li>Limiting the season when prescribed burns would occur to the dormant season would have moderate, direct, short-term impact on the refuge vegetation by allowing higher survival rates for understory vegetation that would compete with young pines.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Continued public use of the existing nature trail and canoe/kayak launch, and deer hunting throughout the refuge, would result in negligible, direct, short-term impacts on the refuge’s forest vegetation.</li> </ul>	<p>long-term impacts to refuge vegetation.</p> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Conversion of 2 forested acres to non-forested upland at the weather station would result in negligible, direct, long-term impacts to the pine-dominated forest.</li> <li>Minor, direct, short-term impacts to small patches of mature moist hardwood forest would result from thinning and prescribed burning activities in adjacent to pine-dominated forest.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Improvement of existing and creation of new refuge infrastructure to support visitor use on the refuge would result in minor, direct, short-term, and negligible, direct, long-term impacts in the pine-dominated, moist hardwood, and floodplain forests. Short-term, minor impacts to forest vegetation would be primarily associated with the use of heavy equipment to remove trees for trail segment construction, parking establishment, and installation of interpretive signage. In the long term, impacts on vegetation would decrease as the vegetation adjacent to these areas recovers from the temporary use and presence of equipment.</li> </ul>	<p>forest on the refuge.</p> <ul style="list-style-type: none"> <li>Beneficial impacts related to monitoring habitat health through the habitat requirements of the priority refuge species for the moist hardwood forest and floodplain forest would be the same as those detailed under alternative B.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Converting pine-dominated forest to transitional dry hardwood forest would result in moderate, direct, long-term impacts to refuge vegetation because removing a large proportion of the pine canopy through mechanical operations to large blocks of forest would provide an opportunity for invasive plant species to become established.</li> <li>Impacts relating to habitat protection and management of mature moist hardwood forest would be the same as those detailed under alternative B.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts detailed under alternative B.</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
<p><b>Vegetation – Non-forested Habitats</b></p>	<p><b>Beneficial Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Maintaining aquatic habitats as a food source for bald eagles would result in moderate, direct, long-term impacts to water quality.</li> <li>Continuing to maintain the erosional bluff as perching areas for foraging bald eagles would continue to have moderate, direct, long-term impacts for this habitat from limited vegetation removal and reduced potential for erosion.</li> <li>Limited active management in freshwater marsh and shrub swamp, aquatic habitats, and erosional bluff would provide minor, direct, short- and long-term impacts because the ecological integrity of each of these habitats is relatively intact.</li> <li>Continuing to partner with local, State, and Federal agencies to maintain the vegetated riparian areas along the aquatic habitats would provide minor, direct, long-term benefits because riparian areas act to buffer activities that occur on the land from impacts to aquatic habitats.</li> <li>Continuing to implement best management practices for land disturbing and herbicide application activities would provide moderate, indirect, short- and long-term impacts to aquatic habitats because these practices would help to prevent habitat degradation.</li> </ul> <p><u>Public Use and Access</u></p> <p>None identified.</p> <p><b>Adverse Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <p>None identified.</p> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>None identified.</li> </ul>		
	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Continued coordination with partners to monitor water quality at stations within the vicinity of the refuge used to promote the health of the James River watershed would provide minor, indirect, short- and long-term impacts to aquatic habitats because the information collected would help to inform us on progress being made to protect and improve water quality.</li> <li>Mowing native and invasive vegetation in the non-forested upland once per year results would result in negligible, direct, short-term impacts.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Improving the water flow and connectivity along Powell Creek and the freshwater marsh and shrub swamp would result in moderate, direct, short- and long-term impacts to aquatic habitats because there would be an increased flow of materials between the creek and the marsh.</li> <li>Monitoring habitat health through the habitat requirements of the priority refuge species for the freshwater marsh and shrub swamp and erosional bluff would provide minor, indirect, long-term impacts to refuge vegetation.</li> <li>Regular monitoring of shoreline conditions and bank loss within refuge would provide minor, indirect, short-term impacts to erosion bluff habitat within the refuge because observations and data would be used for future planning when determining the site-appropriate shoreline</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Impacts related to monitoring habitat health through the habitat requirements of the priority refuge species for the freshwater marsh and shrub swamp and erosional bluff would be same as those detailed under alternative B.</li> <li>Beneficial impacts on erosional bluff relating to regular monitoring of shoreline conditions and bank loss would be the same as those detailed under alternative B.</li> <li>Clearing new logging decks and planting native grasses would have minor, direct, short- and long-term impacts to non-forested upland habitat because grassland plant abundance and species diversity would increase following establishment.</li> <li>Monitoring habitat health of the non-forested upland through the habitat requirements of migratory and breeding northern woodcock and resident bobwhite would</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
<b>Vegetation – Non-forested Habitats (cont.)</b>	<p>vary among alternatives.</p> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Public use of the existing nature trail and canoe/kayak launch would continue to result in negligible, direct, short-term impacts on the refuge’s freshwater marsh and shrub swamp, as well as aquatic habitats.</li> </ul>	<p>stabilization techniques and planting options.</p> <ul style="list-style-type: none"> <li>Impacts from mowing vegetation in the non-forested upland would be same as alternative A.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Improvement of existing and creation of new refuge infrastructure to support on-refuge visitor use would result in minor, direct, short-term impacts, and negligible, direct, long-term impacts in the freshwater marsh and shrub swamp.</li> <li>Opening the refuge to fishing at two designated locations along the nature trail and improving the existing canoe/kayak launch on Powell Creek would result in negligible, indirect, short-term impacts to aquatic habitats because the activities would have the potential to disturb SAV beds through human disturbance.</li> </ul>	<p>provide minor, indirect, long-term impacts to refuge vegetation.</p> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts detailed under alternative B.</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
Birds	<p><b>Beneficial Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>We would continue to provide moderate, direct, long-term impacts by maintaining and managing for those habitat qualities that exist on the refuge that directly benefit nesting and wintering bald eagles, including super-canopy trees for nesting and roosting, mature riparian forests with limited to no disturbance, and healthy marsh and aquatic habitats for feeding.</li> <li>Research and monitoring with partner organizations would continue to provide moderate, direct, long-term impacts related to understanding bald eagle breeding and abundance.</li> <li>We would continue to perform invasive species management to provide moderate, direct, long-term benefits to ground nesting birds, cavity nesters, and songbird species.</li> <li>Under all alternatives, retaining the existing mature moist hardwood and floodplain forest habitats would provide minor to moderate, direct, long-term benefits to ground and cavity nesting birds, as well as songbirds and raptors.</li> <li>We would continue current protection of freshwater marsh and shrub swamp habitat, which would have minor, direct, long-term impacts to waterfowl.</li> <li>Improving aquatic habitats through protection and increased partnerships would have minor, direct, long-term impacts on waterfowl and waterbirds due to improved food resources.</li> <li>Tree protection activities that stabilize the erosional bank would have negligible, indirect, long-term impacts on bank swallows because the best management practices attempt to limit disturbance, but erosion caused by the James River continues to create areas where bare soil is present on nearly vertical slopes.</li> <li>Raptor species known to use James River NWR would continue to receive negligible, direct, long-term impacts from being able to forage in the non-forested upland.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>We would continue to provide direct, moderate, long-term impacts to bald eagle nesting areas by managing visitor access in accordance with BGEPA requirements.</li> </ul> <p><b>Adverse Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <p>None identified.</p> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Unclaimed deer carcasses containing lead shot from the shotgun and muzzleloader hunts would continue to have negligible impacts to bald eagles based on the small number of carcasses potentially produced each year.</li> </ul>		
	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Changing the pine-dominated forest structure through pine thinning and burning activities would continue to have minor to moderate, direct, long-term impacts to bald eagles, other raptors, and ground and cavity nesting species.</li> <li>Protecting mast-producing hardwood trees, such as oaks, in the pine-dominated forest would have minor, direct, long-term benefits for wild turkey and other species that can utilize the large nut as valuable food resource, and resident and migrating song birds, which use these species for cover</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>The change in forest structure would have moderate, direct, long-term impacts on bald eagles, other raptors, and other ground and cavity nesting birds from the more well-developed ground layer and open to sparse understory layer, with large pine trees.</li> <li>Increasing the amount and diversity of herbaceous vegetation through thinning and prescribed fire would have moderate, direct, short- and long-term impacts on foraging and nesting of ground nesting birds.</li> <li>Increasing efforts to monitor erosion activity and breeding bank</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Transitioning the pine-dominated forest to a dry hardwood forest would have minor to moderate, direct, long-term impacts to raptors, ground and cavity nesters, resident songbirds, and neotropical migratory species because of the adjustment of the foraging and nesting habitat conditions that would result from the forest conversion process.</li> <li>Expanding logging deck size and converting these areas to non-forested upland would have minor, direct, long-term impact to ground nesting birds because we would be increasing the acreage</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
<p><b>Birds (cont.)</b></p>	<p>and nesting.</p> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Prescribed burn activities conducted according to the prescribed fire plan would have negligible, indirect, short-term impacts to bald eagles.</li> <li>• Thinning activities would potentially have moderate, direct, short-term impacts on nesting and foraging bald eagles because it is a prolonged activity (occurring over several weeks) and involves human and vehicle activity that produces noise.</li> <li>• Thinning and prescribed burning would potentially have minor, direct, short-term impacts on ground or cavity nesting or songbird species, through disturbance during the nesting season that would destroy nests or causes abandonment.</li> <li>• Natural tree loss due to erosion, wind storms, or disease along the erosional bank would have a negligible, direct, long-term impact to cavity nesting birds because the erosional bank habitat represents a relatively small portion of the trees within the refuge available for nesting.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Public access to trails, hunts, and education programs on the refuge would result in negligible, indirect, short-term impacts to nesting, foraging, or breeding birds.</li> <li>• Deer hunt program would have negligible, indirect, short-term impacts on other bird species due to limited days and season.</li> <li>• Wildlife observation, photography, environmental education, and interpretation would have a negligible, short-term, indirect</li> </ul>	<p>swallow population in the erosional bluff habitat on the refuge would have negligible to minor, direct, long-term impacts.</p> <ul style="list-style-type: none"> <li>• Creation and revegetation of logging decks to native grass species would provide minor impacts for Chuck-will’s-widow, wild turkey, and northern bobwhite because the logging decks would be small forest openings that could be used for foraging.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Increased and improved environmental education and interpretation of the refuge’s birds and their habitat requirements would provide negligible, direct, long-term impacts by helping to increase public understanding of and appreciation for bald eagles, as well as waterfowl and waterbirds.</li> <li>• University research partnerships and education programs would provide minor, direct, long-term impacts by helping to increase knowledge about and awareness of different bird groups using the refuge, including ground nesting birds, cavity nesting birds, raptors, neotropical migratory birds, waterfowl, marsh birds, and bald eagles.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Thinning and prescribed burning would have minor to moderate, short-term impacts on ground or cavity nesting or songbird species from increased disturbance during the nesting season that would destroy nests or cause abandonment.</li> <li>• Reduced midstory structure would result in moderate, indirect, long-term impacts to neotropical migratory birds because the habitat that they utilize during migration would be reduced.</li> </ul>	<p>and improving the quality of this type of habitat.</p> <ul style="list-style-type: none"> <li>• Impacts on bank swallow populations related to increased monitoring the erosional bluff habitat would be the same as alternative B.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Impacts to birds due to increased and improved environmental education and interpretation would be the same as alternative B.</li> <li>• University research partnerships and education programs would provide the same impacts as alternative B.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Prescribed burning would have negligible, direct, short-term impacts to other raptors, ground and cavity nesters, and songbird species because low intensity burns would only occur once or twice to achieve desired results.</li> <li>• Forest management activities to convert the pine-dominated forest to a transitional dry hardwood forest would result in minor to moderate, direct and indirect, short-term impacts to bald eagles, other raptors, ground and cavity nesters, and songbirds because the associated noise and emissions from equipment operation would potentially disturb them from nests and roosting trees. Impacts to bird species would be reduced to negligible over time because thinning activities would decrease as the target tree densities are achieved.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Spring turkey hunt would result in negligible to minor, indirect, short-term impacts to bald eagles and other nesting species.</li> <li>• Offering 1 day of youth</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
Birds (cont.)	<p>impact on nesting, roosting, and foraging bald eagles, raptors, and songbirds.</p>	<p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Offering spring turkey hunting would result in negligible, indirect, short-term impacts to bald eagles and other nesting bird species.</li> <li>• Offering 1 day of youth waterfowl hunt would have a negligible, direct, short-term impact to waterfowl because the season would be limited to 10 days during the State season and involve at least one youth hunter per licensed adult companion at one location within the refuge.</li> <li>• Expanding the deer hunt and opening the refuge to turkey hunting would have a negligible, indirect, and long-term impact on birds because of an increased potential to ingest lead shot. We would encourage hunters to use lead-free shot.</li> <li>• Constructing a nature trail, a wildlife observation platform, and fishing platform would have minor, indirect, short-term impacts to nesting bald eagles, raptors, ground and cavity nesters, and songbirds.</li> <li>• Trail use would result in minor, direct, long-term impacts to bald eagles, other raptors, cavity and ground nesters, and songbirds (including migratory birds).</li> <li>• Canoe/kayak launch would result in increased boat traffic that would have minor, direct, short-term impacts to waterfowl and waterbirds.</li> <li>• Increased vehicular traffic would have minor, direct, short- and long-term impacts to bird species that would be observed on or along the State roads within the refuge.</li> <li>• Opening the refuge to fishing at two designated locations along Powell Creek would result in negligible to minor, indirect, long-term impacts to bald eagles, songbirds, waterfowl, and waterbirds from possible lead tackle ingestion. We would</li> </ul>	<p>waterfowl hunting impacts on birds would be the same as alternative B.</p> <ul style="list-style-type: none"> <li>• The potential for birds to ingest lead resulting from expansion of the deer hunt and opening the refuge to turkey hunting would be the same as detailed under alternative B.</li> <li>• Impacts to bald eagles, other raptors, ground and cavity nesters and songbirds from increased public use opportunities by expanding the existing nature trail, constructing a wildlife observation platform and a fishing platform, and improving the existing canoe/kayak launch would be the same as alternative B.</li> <li>• Use of the wildlife drive by refuge visitors would have minor, direct and indirect, long-term impacts to bald eagles, other raptors, resident and migratory songbirds.</li> <li>• Opening the refuge to fishing would have the same impacts to bald eagles and other bird species as alternative B</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
Birds (cont.)		encourage fishermen to use lead-free tackle.	
Fisheries	<p><b>Beneficial Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Protection of the mature moist hardwood forest, floodplain forest, and freshwater marsh and shrub swamp would provide moderate, indirect, long-term impacts to fisheries because preserving the quality of these habitats would reduce impacts on water quality.</li> <li>Continuing partnerships with the State to monitor or improve aquatic habitat would result in minor, indirect, long-term impacts to fisheries because information collected during monitoring would allow us to understand the current condition of the James River and its tributaries within the refuge.</li> </ul> <p><u>Public Use and Access</u></p> <p>None identified.</p> <p><b>Adverse Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>If misused or spilled, herbicides to control invasive plant species would possibly result in negligible, direct and indirect, short-term impacts to fisheries. Under all alternatives we would minimize impacts by implementing the best management practices for herbicide application, including safe handling and storage practices, using the minimal effective dosage, utilizing application methods that minimize non-target impacts, timing applications to coincidence during the optimal growth stage, and adhering to label requirements.</li> <li>Ground disturbing activities would result in negligible, indirect, short- and long-term impacts to fisheries if loose soils enter nearby waterways.</li> <li>Under all alternatives, we would minimize impacts through implementing best management practices during ground-disturbing activities.</li> </ul> <p><u>Public Use and Access</u></p> <p>None identified.</p>		
	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Opening refuge to fishing at two designated locations along Powell Creek would result in minor, indirect, long-term impacts by helping to increase public understanding of and appreciation for our fisheries resources on the refuge and in the James River watershed.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Opening refuge to fishing and allowing this use throughout the year from sunrise to sunset</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts detailed under alternative B.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts detailed under alternative B.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts detailed under alternative B.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts detailed under alternative B.</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
Fisheries (cont.)		without a refuge-issued permit would possibly result in negligible, indirect, short-term impacts on fisheries.	
Mammals	<p><b>Beneficial Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Continuing to protect the mature moist hardwood forest and floodplain forest would have moderate, direct, long-term impacts on mammals because their habitat and food resources would be plentiful on the refuge throughout the year.</li> <li>Pest and invasive species control would continue to have negligible to minor, indirect, long-term impacts on mammals because this activity protects existing habitat and food resources.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Conducting public deer hunts would result in minor, indirect, long-term impacts by building the public's connection to the deer populations and their habitats.</li> <li>Actively monitoring the refuge deer population in conjunction with VDGIIF would continue to have minor, direct, long-term impacts because we would collect information that would help us monitor the deer herd health.</li> </ul> <p>•</p> <p><b>Adverse Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Prescribed burning activities would continue to have negligible, indirect, short-term impacts to mammals.</li> <li>Invasive species control would continue to have negligible, direct, short-term impacts to small rodents because they would experience loss of cover vegetation.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Hunt program would continue to have negligible, direct, long-term impacts on non-target mammals because their interactions with humans would continue to be rare. Under all alternatives, hunting on the refuge occurs during specific, narrow time periods. Based on the number of hunters, the number of hunt days, and the areas designated for hunting, adverse interactions between humans and non-target mammals during the hunt season(s) would be rare.</li> </ul>		
	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Thinning in the pine-dominated forest habitat would have minor, direct, long-term impacts to mammals because opening the canopy will increase size of mature trees and provide light for herbaceous vegetation.</li> <li>Protection of mast producing trees in the pine-dominated forest during forest management activities would have minor, direct, long-term impacts to mammals by providing an important food resource.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same impacts as detailed under alternative A.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Increased public access to trails for wildlife photography, observation, interpretation and education would result in negligible to minor, indirect, short-term impacts as knowledge and appreciation of mammalian species and their habitats is fostered.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Thinning in the pine-dominated forest would have minor, direct, short- and long-term impacts to mammals because of noise disturbance and because these</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Beneficial impacts to mammals due to thinning activities would be same as detailed under alternative B.</li> <li>Converting pine-dominated forest to a transitional dry hardwood forest would have minor, direct, long-term impacts to mammals because this forest management approach would seek to increase mast producing trees, resulting in improved foraging opportunities.</li> <li>Converting the pine-dominated forest to a transitional dry hardwood forest would result in larger logging decks that we would manage as non-forested upland, which would also be feeding sites, conveying a negligible to minor, direct, long-term impact on mammals.</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
<b>Mammals (cont.)</b>	<p><b>Adverse Impacts</b>  <u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul>	<p>activities would result in reduced food resources and midstory cover.</p> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Expansion of the nature trail, construction of a wildlife observation and photography blind and a fishing platform, improvement of the existing canoe/kayak launch, and increase in refuge visitation in the designated public use area would have negligible, indirect, long-term impacts to mammals.</li> </ul>	<p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Increased public access to trails and wildlife drive for wildlife observation, photography, environmental education, and interpretation would result in negligible to minor, indirect, short-term impacts as knowledge and appreciation of mammalian species and their habitats is fostered.</li> </ul> <p><b>Adverse Impacts</b>  <u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Thinning in the pine-dominated forest would have negligible, direct, short- and long-term impacts to mammals because of noise disturbance associated with thinning operations.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Adverse impacts on mammals due to improvement of existing and construction of new infrastructure would be the same as detailed under alternative B.</li> <li>Construction, maintenance, and use of the wildlife drive would have minor, direct, short- and long-term impacts from increased vehicle traffic.</li> </ul>
<b>Amphibians and Reptiles</b>	<p><b>Beneficial Impacts That Would Not Vary by Alternative</b>  <u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Preserving the mature moist hardwood forest and floodplain forest would continue to provide moderate, direct, short- and long-term impacts to amphibians and reptiles, providing them with important wintering, breeding and foraging habitat.</li> <li>Invasive plant species control in mature moist hardwood forest, floodplain forest, and freshwater marsh and shrub swamp would have negligible, indirect, short- and long-term impacts to amphibians and reptiles because the natural hydrology of these habitats would be protected and native plant species, which are important food resources for amphibians and reptiles, would remain undisturbed.</li> </ul> <p><u>Public Use and Access</u>  None identified.</p> <p><b>Adverse Impacts That Would Not Vary by Alternative</b>  <u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Invasive species control would result in minor, indirect, short-term impacts to amphibians and reptiles because herbicide applications would reduce vegetation cover that these species may use.</li> </ul> <p><u>Public Use and Access</u>  None identified.</p>		

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
<p><b>Amphibians and Reptiles (cont.)</b></p>	<p><b>Beneficial Impacts</b> <u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Tree removal in the pine-dominated forest would have minor, direct, long-term impacts on amphibian and reptile species by increasing herbaceous and invertebrate food sources and increasing mobility and cover through the habitat.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b> <u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Prescribed burning and thinning operations would have minor, direct, short-term impacts to amphibian and reptile species.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>The existing nature trail would continue to have negligible, direct, long-term impacts because the trail intersects forest habitat and certain amphibian species avoid roadsides or forest openings in their movements.</li> </ul>	<p><b>Beneficial Impacts</b> <u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Forest management for the pine-dominated habitat would provide moderate, direct, long-term impacts to amphibians and reptiles because the resulting pine savanna would provide an open understory that would allow light and opportunity for herbaceous plant species to flourish.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Increased public access to trails for wildlife photography, observation, interpretation and education would result in negligible to minor, indirect, short-term impacts as knowledge and appreciation of amphibian and reptile species and their habitats is fostered.</li> </ul> <p><b>Adverse Impacts</b> <u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Thinning, prescribed burning, and ground disturbing activities in the pine-dominated forest would result in minor, direct, short-term impacts to amphibians and reptiles because equipment would compact the soil while these activities were taking place.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Construction of the expanded nature trail, a wildlife observation and photography blind, and a fishing platform would result in minor, direct, short- and long-term impacts.</li> <li>Expansion of the nature trail, construction of a wildlife observation and photography blind and a fishing platform, improvement of the existing canoe/kayak launch, and increase in refuge visitation in the designated public use area would result in negligible, direct, short-term impacts to amphibians and reptiles.</li> </ul>	<p><b>Beneficial Impacts</b> <u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Converting the pine-dominated forest to a transitional dry oak hardwood forest would result in moderate, direct, long-term impacts to amphibians and reptiles because the transitional dry hardwood forest would be contiguous with the existing mature moist hardwood and floodplain forests and help to provide travel corridors for amphibians and reptile species movement.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Increased public access to trails for wildlife photography, observation, interpretation and education would result in impacts same as alternative B.</li> </ul> <p><b>Adverse Impacts</b> <u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Clear cutting or selective cutting of the pine-dominated forest would result in moderate, direct, short-term impacts to amphibians and reptiles because these activities would result in ground disturbance.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Impacts from construction and increased visitor use of the expanded nature trail, wildlife observation platform, and canoe/kayak launch would be same as alternative B.</li> <li>Construction, maintenance, and use of the wildlife drive would have minor, direct, short- and long-term impacts, from disrupting amphibian and reptile movement, or resulting in injury or mortality of individuals by collision.</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
Invertebrates	<p><b>Beneficial Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Timber removal operations would provide minor to moderate, direct, short- and long-term impacts to invertebrate diversity and populations.</li> <li>• Protection of the mature moist hardwood forest and floodplain forest would continue to provide minor to moderate, direct, long-term impacts to invertebrates.</li> <li>• Protection of freshwater marsh, shrub swamp, and aquatic habitats would have moderate, direct, long-term impacts on invertebrate populations.</li> <li>• Increased monitoring of invasive plant and animal species would result in minor, indirect, long-term benefits to invertebrates because we would prevent a decline in native invertebrate species caused by changing habitats conditions resulting from invasive species.</li> </ul> <p><u>Public Use and Access</u></p> <p>None identified.</p> <p><b>Adverse Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Prescribed burning activities in the pine-dominated forest would result in minor, direct, short-term impacts to invertebrates because a decrease in invertebrate abundance would directly result from a prescribed burn.</li> <li>• Invasive species control would result in minor, indirect, short-term impacts to invertebrates in areas where invasive species are present.</li> <li>• Thinning and prescribed burning activities in the pine-dominated forest would result in minor, direct, long-term impacts to pine beetles.</li> </ul> <p><u>Public Use and Access</u></p> <p>None identified.</p>		
	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Same as the impacts that do not vary among alternatives.</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Transitioning the pine-dominated forest to a pine savanna would result in moderate, direct, long-term benefits to invertebrates by creating increased food sources.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Prescribed fire used to maintain the pine savanna habitat would have minor, direct, short-term impacts to invertebrate populations.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Same as the impacts that do not vary among alternatives.</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Conversion to a mixed pine-hardwood forest that requires little forest management will have minor, direct, long-term impacts to invertebrate populations.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Clear-cuts during the pine to hardwood transformation process would have moderate, direct, short-term impacts on invertebrate populations.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Same as the impacts that do not vary among alternatives.</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
Public Use and Access	<p><b>Beneficial Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u> None identified.</p> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Continuing to offer quality deer hunting opportunities on the refuge would result in minor to moderate, direct, short- and long-term impacts on the hunting community.</li> <li>Continuing to offer environmental education programs on the refuge would result in negligible, direct, short- and long-term impacts for refuge visitors.</li> </ul> <p><b>Adverse Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Limiting public use and access to areas of the refuge and during certain times of the year to achieve our biological management objectives and protect public health and safety would continue to have negligible to minor, direct, long-term impact on public use of and access to the refuge.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Geographic and time-of-year restrictions would continue to be imposed on refuge visitation.</li> </ul>		
	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Protection and management of wildlife habitats on the refuge would result in moderate, indirect, short- and long-term impacts on public use and access to the refuge.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>The existence of the refuge would continue to provide minor, direct, long-term impacts for refuge visitors to be able to make meaningful connections with nature.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Habitat protection and management activities would continue to result in minor, direct, long-term impacts to public use and access from limited access to the refuge.</li> <li>Lack of trail infrastructure and competing non-compatible habitat management actions would continue to have moderate, direct, short- and long-term impacts to public use opportunities.</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Forest management activities, especially the thinning and burning activities in the pine-dominated forest, would have negligible, direct impacts on refuge hunting opportunities in the short and long term, creating a more open landscape and allowing better viewing by hunters.</li> <li>Ongoing habitat protection and management within the floodplain forest, freshwater marsh and shrub swamp, and aquatic habitats would have minor, indirect, long-term impacts on fishing opportunities by helping to protect water quality and maintain suitable fish habitat.</li> <li>Forest management activities would have negligible, direct, long-term impacts on wildlife observation, photography, environmental education, and interpretation opportunities, from opening up the forest and increasing visibility and possibly provide more opportunity for wildlife observation.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Expanding the refuge's deer hunt program would result in moderate, direct, short- and long-term</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Forest management activities would have moderate, direct, long-term impacts on the deer hunt because increased visibility would be provided for hunters after approximately 10 years, when the tree height starts to create canopy that shades out volunteer trees.</li> <li>Impacts to fishing would be the same as those under alternative B.</li> <li>Forest management activities would have moderate, direct, long-term impacts to wildlife observation, photography, environmental education, and interpretation, by providing increased visibility for these activities after approximately 10 years, when the tree height of the transitional forest would reduce the density and improved visibility would result.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Expanding the refuge's deer hunt program (not including the archery hunt) would result in impacts same as those under alternative B.</li> <li>Expanding the nature trail and creating the wildlife drive would provide minor, direct, long-term benefits to those visitors who want to engage in wildlife</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
<p><b>Public Use and Access (cont.)</b></p>	<p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Continuing to use permit system and requiring that visitors obtain a permit 3 days prior to their visit for any public access that is not a refuge-sponsored event would possibly result in minor, direct, short-term impacts to visitors who want to visit the refuge while they are in the area for a short period of time, or were not able or aware of the permit requirement prior to their desired visit.</li> <li>Refuge closure during deer hunting season to other public uses would continue to have minor, direct, and short-term impacts on wildlife observation, photography, environmental education, and interpretation.</li> </ul>	<p>impacts on the hunting program by increasing the total number of deer hunting opportunities on the refuge.</p> <ul style="list-style-type: none"> <li>Opening the refuge to turkey and waterfowl hunting would help to attract new hunters to the refuge specifically for turkey or waterfowl hunting. Additional NEPA review and analysis is required to fully characterize the impacts of our proposal to open the refuge for these new hunts.</li> <li>Construction of a wildlife observation blind that would serve as waterfowl hunting blind on specific dates in the year would provide minor, direct, short- and long-term impacts to refuge visitors, who would also be able to use the blind outside of hunting periods for wildlife observation, photography, environmental education, and interpretation.</li> <li>Opening James River NWR to recreational fishing at two designated locations for up to 1,460 anglers annually would result in moderate, direct, long-term impacts to the recreational fishing community by increasing recreational fishing opportunities and access to fishing information along the Lower James River.</li> <li>Improving the infrastructure at the canoe/kayak launch site to establish it as a fishing location and creating a second fishing location would result in moderate, direct, long-term impacts to those wanting to fish at the refuge.</li> <li>Expanding the nature trail would create minor, direct, long-term benefits to those visitors who want to engage in wildlife observation, photography, environmental education, and interpretation on the refuge.</li> <li>Eliminating the need for visitors to request a refuge-issued permit three business days in advance of proposed visit would have moderate, direct, long-term</li> </ul>	<p>observation, photography, environmental education, and interpretation on the refuge.</p> <ul style="list-style-type: none"> <li>Modifying the archery deer hunt to add 5 additional days and split the hunt into two 12-day seasons to provide twice as many opportunities for a hunter to be selected in the lottery would result in minor, direct, long-term impacts to the archery deer hunt community.</li> <li>Opening the refuge to turkey and waterfowl hunting would help to attract new hunters to the refuge specifically for turkey or waterfowl hunting. Additional NEPA review and analysis is required to fully characterize the impacts of our proposal to open the refuge for these new hunts.</li> <li>Construction of a wildlife observation blind would have impacts same as those detailed under alternative B.</li> <li>Beneficial impacts to public uses and access related to expanding outreach to refuge visitors, including urban communities, would be similar to alternative B.</li> <li>Opening James River NWR to recreational fishing at three designated locations for up to 2,190 anglers annually would result in moderate, direct, long-term impacts to the recreational fishing community, similar to those detailed under alternative B.</li> <li>Beneficial impacts to public uses and access related to improving the existing canoe/kayak launch and designating three fishing sites would be similar to alternative B.</li> <li>Increase in visitors would potentially introduce a larger audience of people to hunting and fishing opportunities on the refuge and result in increased hunting and fishing participation, resulting in negligible, indirect, short-term impacts and minor, direct, long-term impacts.</li> <li>Beneficial impacts to public use</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
Public Use and Access (cont.)		<p>impacts as it would allow for the public to visit the refuge at their convenience.</p> <ul style="list-style-type: none"> <li>Targeting urban audiences would have negligible, direct, and long-term impacts from attracting new participants to the facilities associated with the public use program, especially in refuge- and partner-sponsored programs and events.</li> <li>Additional enhancements to the refuge, including the improved canoe/kayak launch, wildlife observation sites, and expanded parking would have moderate, direct, long-term impacts for those visitors participating in wildlife observation, photography, environmental education, and interpretation.</li> </ul> <p><b>Adverse Impacts</b> <u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Increased pine thinning activity would result in negligible, direct, short-term impacts to deer and turkey hunters by periodically removing hunt locations where thinning is being actively performed.</li> <li>Increased pine thinning activity would result in minor, direct, short-term impacts to wildlife observation, photography, environmental education, and interpretation by limiting the public's ability to access certain portions of the public use area while these activities are occurring.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>To accommodate the expanded nature trail, we would eliminate 16 hunting locations that are current located in the vicinity of the proposed trail location, which would have negligible, direct, long-term impacts because these hunting locations have had low to marginal harvest success compared to other designated</li> </ul>	<p>and access related to relaxing the refuge's permit requirements to visit the designated public use area would be similar to alternative B.</p> <ul style="list-style-type: none"> <li>Creating a wildlife drive would provide access to nature for disabled persons, small children, and the elderly, further expanding the audience served, and providing minor, direct, and long-term impacts.</li> <li>Expanded programming, including up to four wildlife observation boat trips and up to three on-refuge and three off-refuge interpretive programs, would provide negligible, direct, and long-term impacts for the public who want to participate in non-consumptive wildlife-dependent uses.</li> <li>Beneficial impacts to public uses and access related to the expansion of the nature trail and designating public use areas would be similar to alternative B.</li> </ul> <p><b>Adverse Impacts</b> <u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Forest management activity associated with transitioning the forest from being pine-dominated to transitional dry hardwood would potentially result in minor to moderate, direct, short-term impacts to hunters by periodically removing hunt locations where thinning and clear cutting is being actively performed.</li> <li>Increased pine thinning and selective clear cutting activity would result in minor to moderate, direct, long-term impacts to wildlife observation, photography, environmental education, and interpretation by directing visitors away from locations while these activities are occurring.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Impacts to public uses and access related to eliminating hunt</li> </ul>

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Public Use and Access (cont.)		<p>sites within the refuge and because expanded opportunities in other parts of the refuge would accommodate the hunters and offer the potential for greater harvest success.</p> <ul style="list-style-type: none"> <li>• Any noise or refuge disturbance associated with the construction of the expanded trail, the wildlife observation sites, the canoe/kayak launch, and the expanded parking would be negligible, indirect, and short-term related to the hunt program.</li> <li>• With regard to the hunt program, any possible impacts to fishing would depend upon the location of the fishing sites and their relationship to the location of the youth waterfowl hunting sites during the 10 days of the youth waterfowl hunt. At a maximum, fishing would be prohibited from a site for 10 days during the winter.</li> <li>• Increase in users of the refuge who are engaged in wildlife observation, photography, environmental education, and interpretation would potentially cause minor, direct, short- and long-term impacts to the fishing experience by making noise or occupying space around designated fishing areas.</li> <li>• Operators of canoes, kayaks, or non-trailer, hand-launched boats with small electric motors would possibly have minor, direct, short-term impacts to fishing areas when they are either launching or retrieving watercraft or paddling near fishing lines, by disturbing waters adjacent to fishing sites.</li> <li>• Minor infrastructure improvements to make fishing viable would have negligible to minor, direct, short-term impacts to fishing access during construction.</li> <li>• Hunt program would have negligible to minor, indirect, and short-term impacts on visitors engaged in wildlife observation,</li> </ul>	<p>locations from the designated public use area would be similar to alternative B.</p> <ul style="list-style-type: none"> <li>• Impacts to public uses and access related to constructing infrastructure to support increased visitor use in the designated public use area would be similar to alternative B.</li> <li>• Construction of, or improvements to, the wildlife drive would possibly have negligible, indirect, and short-term impacts to the hunting programs from noise and refuge disturbance associated with the construction of these enhanced features.</li> <li>• Hunt program would have minor, direct, short- and long-term impacts on non-hunting refuge visitors because we would close the wildlife drive to wildlife observation, photography, environmental education, and interpretation during hunt days.</li> <li>• Hunt program would have negligible to minor, indirect, short-term impacts on visitors engaged in wildlife observation, photography, environmental education, and interpretation opportunities because hunt zones are located in other portions of the refuge and away from the approved public use area.</li> <li>• On the 10 youth waterfowl hunter use days, impacts would be similar to those detailed under alternative B.</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
<b>Public Use and Access (cont.)</b>		<p>photography, environmental education, and interpretation opportunities because hunt zones are located in other portions of the refuge and away from the approved public use area.</p> <ul style="list-style-type: none"> <li>On the 10 youth waterfowl hunter use days, we would close a small portion of the trail (likely less than 1,000 feet) to minimize the potential for user conflicts and safety concerns, which would have negligible, direct, and short-term impacts.</li> </ul>	
<b>Socioeconomic Environment</b>	<p><b>Beneficial Impacts That Would Not Vary by Alternative</b></p> <ul style="list-style-type: none"> <li>We would continue to pay revenue to Prince George County as part of the Refuge Revenue Sharing Program, resulting in direct, long-term impacts to Prince George County.</li> </ul> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>The exchange of timber product removal for services or materials deemed necessary by the refuge provides a moderate, direct, long-term impact on the local economy.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Local economy would continue to receive moderate, indirect, long-term impacts from expenditures related to deer hunting on the refuge. While all the alternatives include hunting, the degree of beneficial socioeconomic impact from hunting would vary by alternative.</li> </ul> <p><b>Adverse Impacts That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <p>None identified.</p> <p><u>Public Use and Access</u></p> <p>None identified.</p>		
	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Increased hunting opportunities and addition of fishing on the refuge would bring minor, indirect, long-term impacts to the local economy from additional visitor expenditures.</li> <li>Increased opportunities for visitors to participate in wildlife observation, photography, environmental education, and interpretation on the refuge would have minor to moderate, indirect, long-term impacts on the local economy.</li> </ul>	<p><b>Beneficial Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts detailed under alternative B.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>Increased hunting opportunities and addition of fishing on the refuge would potentially bring moderate, indirect, long-term impacts to the local economy with more hunting opportunities and opening up the refuge to one additional fishing location compared to alternative B.</li> </ul> <p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>Same as the impacts that do not vary among alternatives.</li> </ul>

Service Resource or Program	Alternative A. Current Management (No Action Alternative)	Alternative B. Manage Forest Health with Pine-dominated Component; New, Enhanced, and Focused Public Use Opportunities (Service-preferred Alternative)	Alternative C. Manage Forest Health with Hardwood Conversion Component; New and Expanded Public Use Opportunities
Socioeconomic Environment (cont.)		<p><b>Adverse Impacts</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Same as the impacts that do not vary among alternatives.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Same as the impacts that do not vary among alternatives.</li> </ul>	<p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Same as the impacts that do not vary among alternatives.</li> </ul>
Cultural and Historic Resources	<p><b>Potential for Adverse Effects That Would Not Vary by Alternative</b></p> <p><u>Habitat Protection and Management</u></p> <ul style="list-style-type: none"> <li>• Land-disturbing activities (e.g., clearing trees to establish logging decks, conducting prescribed burns, installation of shoreline erosion controls, new facility construction, mechanical control of invasive plants) have the potential to adversely affect the cultural resources of the refuge. We would implement recommendations outlined in the 2009 Archaeological Overview Study to minimize disturbance and prevent loss or degradation of cultural resources (Goode et al. 2009) and would coordinate with the RHPO, the SHPO, and other partners.</li> </ul> <p><u>Public Use and Access</u></p> <ul style="list-style-type: none"> <li>• Refuge visitors may inadvertently or even intentionally damage or disturb known or undiscovered cultural artifacts or historic properties. We would continue our vigilance in looking for this problem, use law enforcement where necessary, and continue our outreach and education efforts.</li> </ul> <p><b>Avoidance, Minimization, and Mitigation Strategies</b></p> <ul style="list-style-type: none"> <li>• For compliance with Section 106 of the NHPA, the refuge staff would consult the RHPO during the early planning stages of proposed new actions when new ground-altering activities are proposed, evaluate existing facilities for National Register eligibility before altering, and require compliance with standard terms and conditions agreed to by refuge staff for forest management. We would provide a description and location of all projects, activities, routine maintenance, and operations that affect ground and structures, details on requests for compatible uses, and the range of alternatives considered. The RHPO would analyze those undertakings for their potential to affect historic and prehistoric sites, and consult with the SHPO and other parties as appropriate. We would notify the State and local government officials to identify concerns about the impacts of those undertakings.</li> </ul> <p><b>Section 106 Summary for All Alternatives</b></p> <ul style="list-style-type: none"> <li>• After applying the Advisory Council on Historic Preservation criteria of adverse effects, the Service concluded the implementation of any of our alternatives, including the no action alternative, would have the potential to result in an adverse effect on cultural resources that may be eligible for listing in the National Register. As described above, we would use management practices that avoid or resolve adverse effects on cultural resources, in accordance with the NHPA.</li> </ul>		