Chapter 6 Environmental Consequences

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Chapter 6. Environmental Consequences

6.1 Introduction

This chapter provides analyses of the environmental consequences of implementing the alternatives described in Chapter 2. As appropriate, the potential effects of implementing the strategies described under each alternative were assessed for the main environmental resources described in Chapters 3–5, including physical, biological, cultural, and socioeconomic elements. The alternatives are compared side-by-side under each topic, and both the adverse and beneficial effects of implementing each alternative are described. The information used in this analysis was obtained from relevant scientific literature, existing databases and inventories, consultations with other professionals, and professional knowledge of resources based on field visits and experience.

Council on Environmental Quality (CEQ) regulations, which implement the provisions of NEPA, define the types of effects that should be evaluated in an environmental document, including direct, indirect, and cumulative (40 CFR § 1508.7) (CEQ 1997). Direct effects are generally caused by a particular action and occur at the same time and place as the action. Indirect effects are reasonably foreseeable effects caused by the proposed action, but occur later in time. Direct and indirect effects are addressed in the resource-specific sections of this chapter (Sections 6.2.1–6.2.10 for the Refuge and Sections 6.3.1–6.3.16 for the Unit). CEQ provides the following definition of cumulative effects:

> The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.

Cumulative impacts can result from individually minor but cumulatively significant actions over time. This analysis is intended to consider the interaction of activities at the Refuge and the Unit with other actions occurring over a larger spatial and temporal frame of reference.

The overall cumulative effect on the environment from implementing the various alternatives is summarized in Section 6.2.11 for the Refuge and in Section 6.3.17 for the Unit. The cumulative effects analysis has essentially been completed by virtue of the comprehensive nature that the direct and indirect effects associated with implementing the various alternatives have been presented in the other sections of this chapter and in the Appropriate Refuge Uses and the Compatibility Determinations appendices. The cumulative effects sections focus on effects associated with reasonably foreseeable future events and/or actions regardless of what entity undertakes that action.

6.1.1 Effect Ratings Description

Although the analysis shows that none of the alternatives would be expected to result in significant (major) effects, some positive (beneficial) or negative effects are expected. The qualitative terms moderate (intermediate), minor, and negligible are used to describe the magnitude of the effect. To interpret these terms, moderate is of greater magnitude than minor, and minor is of greater magnitude than negligible. The word negligible is used to describe an effect that, when compared with the current situation, or the current situation forecast 15 years into the future, would not be measurable or would be difficult to measure.

The terms below are used to describe the scope, scale, and intensity of effects on natural, cultural, social (including recreational), and economic resources.

- **Neutral or Negligible.** Resources would not be affected (neutral effect), or the effects would be at or near the lowest level of detection (negligible effect). Resource conditions would not change or would be so slight that there would not be any measurable or perceptible consequence to a population, wildlife or plant community, recreation opportunity, visitor experience, or cultural resource. If a resource is not discussed, impacts to that resource are assumed to be neutral.

- **Minor.** Effects would be detectable within a refuge, but would be localized, small, and of little consequence to a population, wildlife or plant community, other natural resources; social and economic values, including recreational opportunity and visitor experience; or cultural resources. Mitigation, if needed to offset adverse effects, would be easily implemented and successful based on knowledge and experience.

- **Moderate or Intermediate.** Effects would be readily detectable and localized within a refuge, but not readily detectable or measurable beyond the refuge. Effects would have measurable consequences to a population, wildlife or plant community, or other natural resources; social values, including recreational opportunity and visitor experience; or cultural resources. Effects to economic values would not be readily detectable beyond the local community. Mitigation measures would likely be needed to offset adverse effects, and could be extensive, moderately complicated to implement, and probably successful based on knowledge and experience.

- **Significant or Major.** Region-wide effects would be obvious and would result in substantial consequences to a population, wildlife or plant community, or other natural resources; social and economic values, including recreational opportunity and visitor experience; or cultural resources. Extensive mitigating measures may be needed to offset adverse effects and would be large-scale in nature, possibly complicated to implement, and may not have a high probability for success. In some instances, major effects would include the irretrievable loss of the resource.

As appropriate, effects are identified as short-term or long-term, local or widespread, and, where data and analyses are available, effects are quantified.

Time and duration of effects have been defined as follows:

- **Short-term or Temporary.** An effect that generally would last less than a year or season.
- **Long-term.** A change in a resource or its condition that would last longer than a year or season.

6.1.2 Summary of Effects

Tables 6-1 and 6-2 provide overviews of the effects under each alternative by indicator. The effects related to implementing each alternative are described in terms of the change from current conditions (i.e., the environmental baseline). Alternative 1, the No-Action alternative, would continue present management actions. However, the consequences of implementing Alternative 1 may have

beneficial, neutral, or negative effects. For example, the continued use of IPM techniques under Alternative 1 to control invasive species would have a minor positive impact on native habitats and species.

Table 6-1. Summary of Effects under CCP Alternatives for Grays Harbor NWR.

	Alternative A (No Action, Current Management)	**Alternative 2 (Preferred Alternative)**
EFFECTS UPON THE PHYSICAL ENVIRONMENT		
Hydrology and Water Quality	Short-term, negligible to minor, negative Long-term, negligible to minor, positive	Short-term, negligible to minor, negative Long-term, negligible to minor, positive
Topography, Geology, and Soils	Short-term, minor, negative Long-term, moderate, positive	Short-term, minor, negative Long-term, moderate, positive
Air Quality	Short-term, minor, negative Long-term, negligible	Short-term, minor, negative Long-term, negligible
EFFECTS UPON WILDLIFE AND HABITAT		
Common to All Wildlife and Habitats	Short-term, negligible to minor, negative Long-term, minor, positive from public use and outreach programs; negligible to minor, positive from inventory, monitoring, and research	Short-term, negligible to minor, negative Long-term, minor, positive from public use and outreach programs; minor to moderate, positive from increased inventory, monitoring, and research
Estuarine Habitats and Associated Species	Short- and long-term, negligible to moderate, positive	Short-term, negligible to minor, negative Long-term, minor to moderate, positive
Forest Habitat and Associated Species	Short- and long-term, negligible	Short-term, minor, negative Long-term, minor to moderate, positive
Threatened and Endangered Species	Short-term, negligible to minor, negative Long-term, minor, positive	Short-term, negligible to minor, negative Long-term, minor to moderate, positive
EFFECTS UPON THE SOCIAL AND ECONOMIC ENVIRONMENT		
General Social Effects	Long-term, minor, positive	Long-term, moderate, positive
Wildlife Observation, Photography, Environmental Education, and Interpretation	Short- and long-term, negligible	Long-term, minor to moderate, positive
Cultural Resources	Negligible	Negligible
Economic	Negligible	Negligible to minor, positive

Table 6-2. Summary of Effects under CCP Alternatives for the Black River Unit.

	Alternative A (Current Management)	Alternative 2 (Preferred Alternative)
EFFECTS UPON THE PHYSICAL ENVIRONMENT		
Hydrology and Water Quality	Short-term, negligible to minor, negative Long-term, negligible to minor, positive	Short-term, negligible to minor, negative Long-term, minor, positive
Topography, Geology, and Soils	Short-term, minor, negative Long-term, negligible to minor, negative	Short-term, minor, negative Long-term, moderate, positive
Air Quality	Short-term, minor, negative Long-term, negligible	Short-term, minor, negative Long-term, negligible
EFFECTS UPON WILDLIFE AND HABITAT		
Common to All Wildlife and Habitats	Short-term, negligible to minor, negative Long-term, negligible to minor, positive from inventory, monitoring, and research	Short-term, negligible to minor, negative Long-term, minor, positive from public use and outreach programs; minor to moderate, positive from increased inventory, monitoring, and research
River and Tributary Channels and Associated Species	Minor, negative to negligible.	Minor to moderate, positive
Bog Habitats and Associated Species	Negligible	Short-term, negligible to minor, negative Long-term, moderate, positive
Shrub Swamp and Associated Species	Negligible	Short-term, negligible to minor, negative Long-term, minor to moderate, positive
Riparian Habitat and Associated Species	Negligible	Short-term, negligible to minor, negative Long-term, minor to moderate, positive
Emergent Marsh Habitat and Associated Species	Negligible	Short-term, negligible to minor, negative Long-term, moderate, positive
Seasonally Flooded, Nonnative Grassland and Associated Species	Short-term, minor to moderate, negative Long-term, negligible	Short-term, minor to moderate, negative Long-term, moderate, positive
Dry, Nonnative Grassland Habitat and Associated Species	Negligible to minor, positive	Short-term, minor, negative Long-term, minor, positive from wildlife and habitat management actions; long-term, negligible to minor, negative from public use

	Alternative A (Current Management)	Alternative 2 (Preferred Alternative)
Mixed Forest and Associated Species	Negligible	Short-term, minor, negative Long-term, minor, positive
Threatened and Endangered Species	Short- and long-term, minor, positive	Short- and long-term, minor to moderate, positive
EFFECTS UPON THE SOCIAL AND ECONOMIC ENVIRONMENT		
General Social Effects	Neutral	Short- and long-term, minor to moderate, positive
Wildlife Observation, Photography, and Interpretation	Neutral	Short- and long-term, minor to moderate, positive
Cultural Resources	Negligible	Negligible
Economic	Negligible	Negligible

6.2 Grays Harbor National Wildlife Refuge

6.2.1 Effects Common to All Alternatives at Grays Harbor National Wildlife Refuge

Effects Common to All Alternatives from Integrated Pest Management (IPM)

Under both alternatives, the Refuge would continue to work with Grays Harbor Noxious Weed Control Agency, Grays Harbor Public Utilities District, Grays Harbor County, the Port of Grays Harbor, WDFW, Washington State Agriculture Department, WDNR, and others to assure the highest priority invasive species threatening estuary habitats are addressed.

Mechanical, cultural, biological, and chemical control methods would be evaluated for eradication, control, or containment of invasive species in order to achieve resource management objectives (see Appendix G. IPM). Pesticide chemical selection and usage will be subject to regionally reviewed State regulations, State and federally approved herbicides and adjuvants, Service-approved Pesticide Use Proposals (PUPs), and EPA's Pesticide General Permit (PGPs). Pesticide chemical selection will also conform to the specific pesticide label requirements and be applied by licensed applicators. Service guidelines direct the Refuge to use the most efficacious pesticide available with the least potential to degrade environmental quality (soils, surface water, groundwater, and air), as well as minimizing potential effect to native nontarget species. Additionally, adjuvants (an additive that increases herbicide effectiveness such as increasing adhesion to target plants) should have the least potential effect to native nontarget species.

Potential effects to the biological and physical environment are associated with the proposed site-, time-, and target-specific use of pesticides. PUPs on the Refuge would be evaluated using scientific information and analyses documented in "Chemical Profiles" (see Appendix G). These profiles provide quantitative assessment and screening tools and threshold values to evaluate potential effects to species groups (birds, mammals, and fish) and environmental quality (water, soil, and air). Any pesticide use must be approved through a PUP. PUPs (including appropriate BMPs) would be approved where the Chemical Profiles provide scientific evidence that potential impacts to the

Refuge's biological resources and its physical environment are likely to be only minor, temporary, or localized in nature.

Based on scientific information and analyses documented in Chemical Profiles, most pesticides allowed for use on Refuge lands and waters would be of relatively low risk to nontarget organisms as a result of low toxicity or short-term persistence in the environment. Thus, potential impacts to Refuge resources and neighboring natural resources from pesticide applications would be expected to be minor, temporary, or localized in nature.

Some risks may still occur via factors not assessed under current protocols, such as intermingling of unlike chemicals in the field, species-specific sensitivity that differs from surrogate species sensitivity, exposure through inhalation, exposure through ingestion of pesticide-contaminated soil, and other factors (see Appendix G).

The effects of nonpesticide IPM strategies to address pest species on the Refuge would be similar to those effects described elsewhere in this chapter, where they are discussed specifically as habitat management techniques to achieve resource management objectives on the Refuge.

The associated fieldwork of invasive plant control can temporarily cause wildlife to move away and slight habitat disturbances. Invasive species may be spread by moving Refuge equipment from site to site. These species may also become established where soils and existing plant cover is disturbed. The Refuge equipment operators would be required to clean equipment before moving between sites to reduce the spread of seeds and plant parts. The Refuge would continue to monitor habitats for invasive weeds, aggressively control invasive plants, and restore sites to vegetation with high wildlife value. If mechanical methods are not expected to be effective or would have undesirable consequences, such as the destruction of desirable vegetation that is interspersed with weed species, then the Refuge may decide to use an herbicide. Employment of a conservative approach with herbicides would result in minor, localized, short-term negative effects and negligible long-term effects from chemical exposure. Long-term negative effects are not expected; instead, the effects should be positive on fish and wildlife as their respective habitats would be in better condition to support each species group.

Effects Common to All Alternatives Regarding Nature Center and Other Facilities Planning

In 2007, the Service developed a conceptual building design for a nature center and associated facilities, based on standard designs for Refuge facilities, to be located within a 4-acre site along the east boundary of the Refuge and the west side of Paulson Road. Under all alternatives, the Service proposes to work with other agencies, current and new partners, the local community, and others to review the 2007 nature center plan and to evaluate other options, including alternate funding, sites, and designs, that could lead to a viable solution that meets the purpose and need. If implemented, the Refuge would work with partners to develop biological, ecological, and cultural education and interpretative content as well as any associated facilities (e.g., trails, viewing platforms). However, prior to implementation, more detailed planning, design, and appropriate evaluation would need to be undertaken, including additional effects assessment in compliance with NEPA, evaluation and consultation under Section 7 of ESA, and surveys and consultation under Section 106 of NHPA. Further discussion of impacts would depend upon site selection for and design, construction, and operation of the facilities.

Effects Common to All Alternatives Regarding Estuary Restoration

An estuary restoration project that includes berm removal is planned under Alternatives 1 and 2. This project was identified as a mitigation project for Grays Harbor Refuge in the 2004 Nestucca Oil Spill Plan. With project funding, approximately 15–20 acres of compromised salt and brackish marsh habitat would be restored to a more natural function with the removal of the artificial berm. The Service would coordinate with Federal, State, and county agencies on restoration design review.

The artificial berm runs northwest to southeast through the eastern portion of the Refuge and occurs in two sections, separated by a slough that runs through the Refuge (Map 1). The south berm is approximately 900 feet long by 13 feet wide by 3 feet high. The north berm is similar in width and height, and approximately 500 feet long. Heavy equipment would be used to remove the berm down to grade. Berm materials (approximately 1,350 cubic yards) would need to be hauled offsite. Historic tidal channels would be reconnected and graded to encourage water flows within the upper saltmarsh and eliminate ponding of water.

In the short term, construction activities requiring the use of heavy equipment to remove the artificial berm could lead to temporary localized increases in water turbidity, contribution of sediment to the estuary, and impacts to estuarine soil quality such as compaction and loss of soil organic matter. These activities also bring the risk of water contamination with petroleum products. However, the implementation of BMPs associated with all construction activities would reduce the likelihood of excess turbidity, sedimentation, contamination, and ground disturbance. To decrease soil compaction, minimize the creation of unwanted depressions, and encourage quicker growth of native vegetation in the area, a combination of wide-tracked equipment with low ground pressure would be used (e.g., excavator, bulldozer). Overall, implementation of the restoration is expected to have negligible to minor short-term negative effects and minor positive long-term impacts to hydrology and water quality. Expected effects to soils would be minor and short-term but moderately beneficial in the long term.

Mosquitoes are a natural part of the Refuge's ecosystem and are a natural occurrence in salt marsh habitats. It is unknown if the berm allows for a larger than normal mosquito population due to the ponding effects created by the reduction in tidal flows within the saltmarsh. However, removal of the berm and attention to channel elevations would improve tidal movement and minimize ponding of water, thereby reducing mosquito reproduction. This restoration would likely have a negligible effect on reliant species (birds) or as a nuisance to humans.

This project would enhance habitat values and benefit migratory and resident shorebirds, waterfowl, seabirds, and wading birds by providing better quality cover at low tides, larger open water habitat during high tide, and improved foraging areas for a diversity of wildlife, plants, and fish species. Additional species that may benefit include the long-tailed weasel, river otter, garter snake, terrestrial and aquatic insects, and possibly Newcomb's littorine snail.

If present, when tides are at a very high level which allows marsh inundation, federally listed juvenile green sturgeon, bull trout, and eulachon could experience negligible to minor localized short-term negative effects associated with potential increases in sediments in the water caused by restoration actions. The berm deconstruction would take place during low tides, would be a temporary, one-time action of short duration, and would not likely create significant negative impacts to listed species. The twice-daily tides would likely dissipate excess sediments from berm removal activities. Staff would utilize proper BMPs and meet all permit requirements such as approved in-

water work widows, June 15–Feb 28 (salmon) and July 16–February 15 (bull trout), for fish protection. Long-term effects of estuarine restoration would be minor to moderately beneficial to these and other species since they would gain better access to areas of salt marsh and ultimately better foraging areas.

The overall beneficial effects for this action would be moderate, with long-term positive effects on the overall health and quality of the salt and brackish marsh habitats and wildlife. Once the artificial berm is removed, full tidal circulation would occur allowing the quality and complexity of saltmarsh habitat to improve. Without the vegetated berm, the highest high tides and storm flood events would spread out evenly across the salt marsh and help to reestablish functional processes of the saltmarsh. The deeper channels in the sloughs would no longer pond water behind the berm, thereby reducing the potential to trap fish. Wildlife would likely inhabit and utilize larger areas across the entire salt marsh. Native estuarine plants (e.g., pickleweed, tufted hairgrass, seashore salt grass, Lyngby's sedge) would repopulate the restoration area as twice-daily tidal flows naturally spread available seeds. The establishment of additional native plant species would provide high quality detritus to estuary water and provide better quality habitat for native marine invertebrates and fish during high tide. Monitoring and adaptive management would ensure the project habitat and wildlife goals are achieved over time.

Effects Common to All Alternatives Regarding Sweetgrass

Sweetgrass is a component of saltmarsh vegetation and is an important tribal resource that is used for traditional cultural practices. Under Alternatives 1 and 2, the Refuge would continue to monitor and manage the sweetgrass stands for stand health, focusing on removing invasive plants that outcompete native sweetgrass. Short-term, minor negative effects to sweetgrass may be incurred while using IPM methods to control invasive plants. Methods to control problem plants include digging them out or applying a State-, Service-, and EPA-approved aquatic herbicide (see Appendix G). Long-term beneficial effects to sweetgrass range from minor, if little work is needed, to moderate if dense invasive plant development occurs. Beneficial effects are magnified as there are relatively few other sweetgrass stands known in the Grays Harbor estuary.

Additionally, under all alternatives, the Refuge would continue to support traditional cultural use and issue SUPs to Native American tribal members for gathering sweetgrass. Permit stipulations are designed to provide long-term habitat protection and to sustain a thriving population of sweetgrass on the Refuge, leading to negligible to minor negative impacts. Compatibility determinations in Appendix B have more information on plant gathering (sweetgrass).

6.2.2 Effects to the Physical Environment at Grays Harbor National Wildlife Refuge

Effects to Hydrology and Water Quality

Under Alternatives 1 and 2, the proposed saltmarsh restoration with berm removal is anticipated to have negligible to minor, short-term, negative effects and minor, long-term, positive impacts to hydrology and water quality. See Section 6.2.1 Effects Common to All Alternatives Regarding Estuary Restoration for more information.

Minor, short-term impacts to water quality could occur under both alternatives, stemming from the control of invasive plant species. In situations where mechanical and cultural invasive plant control methods are ineffective, the Refuge may use approved herbicides in accordance with the Refuge's IPM program. Although mechanical removal has the potential to expose soils to wind and water erosion, this activity would be limited, largely due to the use of hand tools and would focus on individual plant removal, rather than the removal of large areas of vegetation. Therefore, the continuation of this control method is not expected to introduce substantial amounts of additional sediments into the estuary. The use of herbicides or pesticides to control invasive plants or animals also poses several environmental risks, including drift, volatilization, persistence in the environment, water contamination, and harmful effects to wildlife. The potential for such risks are considered minimal due to the types of herbicides used (nonpersistent) and the precautionary measures taken during application (see Appendix G.). Effects would not be considered significant under any alternative.

Under both alternatives, the Service is committed to working with partners in order to perform rapid response to oil spills or other contaminant events in Grays Harbor estuary in accordance with the Grays Harbor Geographic Response Plan. This strategy would provide moderate positive impacts in the event of contamination or water quality issues.

Under Alternative 2, the design and construction of viewing platforms, boardwalk/trail extensions, and interpretive panels would be strategic to minimize short-term and long-term negative impacts to water quality. BMPs would be incorporated into the placement, design, and construction to address potential short-term and long-term effects, such as stormwater runoff and erosion control. Anticipated effects would be minor negative in the short term and negligible to minor negative in the long term.

Overall Effects

Under both alternatives, Refuge hydrology and water quality would experience an overall negligible to minor, long-term, positive effect. Some localized, short-term, negative effects might occur associated with various invasive species removal efforts or other habitat management activities including the berm removal, although they would be minimized by implementing BMPs. Alternative 2 proposes the construction of viewing platforms, boardwalk/trail extensions, and interpretive panels which would result in slightly increased short-term negative impacts compared to Alternative 1. However, overall short-term impacts under both alternatives would be negligible to minor negative.

Effects to Topography, Geology, and Soils

Common to both alternatives, salt marsh restoration with berm removal would result in minor, short-term, negative effects but moderate, long-term, positive effects. See Section 6.2.1 Effects Common to All Alternatives Regarding Estuary Restoration for more information.

Under Alternative 2, inventory, monitoring, and research addressing questions such as sedimentation rates may have some temporary but negligible to minor, negative effects on the mudflat soils and benthic invertebrates. The proposed study would be beneficial by increasing our knowledge of how sediments move, accrete, and contribute to habitat changes in the Refuge, which would benefit habitat management in the long term.

In Alternative 2, the Refuge would likely use the pin foundation method to significantly reduce the amount of soil compaction and coverage while constructing the boardwalks and viewing platforms (Pin Foundation 2013). All equipment would move to the specific worksite on top of the existing boardwalks and significantly reduce the potential for soil compaction, rutting, or other damage. It is unlikely that heavy equipment would be used in the vicinity of estuarine saltmarsh or upland forest to accomplish one-time construction activities to improve public access with enhanced facilities. However, if heavy equipment is used it would only be during the summer dry season and if necessary at low tide. BMPs would be developed to ensure the least amount of disturbance possible in construction of new boardwalks and viewing platform facilities. Expected negative effects would be minor and short-term.

Overall Effects

In either alternative the overall proposed use of heavy equipment on specific projects may produce temporarily disturbed soils. BMPs would be used to minimize negative effects as much as possible on each construction project. The salt marsh restoration with berm removal would have minor, short-term, negative effects to the soils, but overall will have moderately beneficial effects on estuarine resources. Overall, under both alternatives, minor, short-term, negative effects may occur to specific, small locations of soil; however, in the long term, moderate, positive effects are anticipated.

Effects to Air Quality

The activities proposed may result in a slight and temporary increase in vehicle emissions due to the proposed salt marsh estuarine restoration and new visitor facilities construction identified in the CCP. Once completed, there would be no need for further active management with equipment on these lands.

A slight increase in vehicular emissions could be expected due to an increase in visitation with the proposed visitor services improvements under Alternative 2, including new boardwalk, trails, and viewing platforms.

Overall Effects

Overall, long-term effects to air quality should be negligible under all alternatives. None of the alternatives would be expected to have significant, long-term effects to air quality compared to the environmental baseline. Some minor, short-term impacts to local air quality may result from Refuge management actions.

6.2.3 Effects Common to All Habitats and Wildlife at Grays Harbor National Wildlife Refuge

Under Alternative 1, wildlife-dependent public uses and Refuge outreach programs would continue. These programs play a key role in fostering public understanding, appreciation, and support for the Refuge's native plants and habitats and would lead to long-term, indirect, and minor benefits to the conservation of these resources. Under Alternative 2, the quality and quantity of these programs would expand slightly and lead to similar benefits as in Alternative 1. Disturbance impacts to specific habitat types as a result of public use programs are discussed in the following sections.

Under Alternative 1, inventory, monitoring, research, and scientific assessments regarding natural and cultural resources, public uses, and interactions among these elements would continue as at present. Relative to habitats, plant communities, and wildlife, most of these activities would involve observation and measurement. Occasionally, tissues or whole specimens of native or nonnative plants would be taken, removed, transplanted, or outplanted. Additionally, some of these activities would involve implementing and assessing various habitat management techniques at small scales. Disturbance, including trampling and potentially transporting nonnative species, would be the primary effect of the vast majority of these activities. The effects of some of these activities, such as inventories of invasive plants or evaluations of the contributions of specific habitat management practices to achievement of goals and objectives, would be primarily local.

Management-related research would be evaluated on an individual basis depending on the value and need of the information gained and the short- and long-term impacts. Research that is beneficial and applicable to the Refuge's management programs is more likely to receive approval. Many research projects are conducted by Refuge partners (State, Federal, nongovernment organizations) and universities under the guidelines of a Special Use Permit and would provide positive effects ranging from minor, short-term to moderate, long-term.

Overall, these activities would generate information which would be analyzed and interpreted to help Refuge staff assess the efficacy of management practices and facilitate appropriate course corrections as part of the adaptive management process. The effects of these activities on habitats, plant communities, and wildlife would be negligible to minor and positive. Compatibility determinations included in Appendix B address the effects and conditions associated with these uses in greater detail.

Under Alternative 2, inventory, monitoring, research, and scientific assessments regarding natural and cultural resources, public uses, and interactions among these elements would increase compared to those occurring at present. In addition to generating the same types of effects described for Alternative 1, it would be expected that this would result in an increase in information about the habitats, plant communities, and wildlife within the Refuge. This would reduce uncertainty associated with wildlife and plant responses to habitat management, promote achievement of management goals and objectives, and facilitate adaptive management. For example, this would include better information about the efficacy of pest management programs.

Through application of adaptive management principles, enhanced knowledge would slowly lead to improved management and an increase in the health, productivity, and value of the Refuge's wildlife habitats and plant communities to native vegetation and wildlife and an increase in the abundance and diversity of native wildlife within the Refuge. The effects of these activities on the Refuge's habitats, plant communities, and wildlife would have beneficial minor to moderate effects. Compatibility determinations included in Appendix B address the effects of and conditions associated with these uses in greater detail.

Specific research projects on mudflat sedimentation and sea level rise are priority projects. Some of the associated fieldwork may cause minor, localized, short-term effects such as temporarily causing fish and wildlife to move away from the research site and minor habitat disturbances. Some identified contaminants research may require removing a few individual shorebirds to test for contaminant loads as recommended in the Contaminant Assessment Process (CAP). The collection would negatively affect the individuals, but would cause negligible long-term effects to the west coast shorebird population.

6.2.4 Effects to Estuarine Habitats and Associated Species at Grays Harbor National Wildlife Refuge

Effects of Habitat Management Actions

Common to both alternatives, salt marsh restoration with berm removal would result in minor, short-term, negative effects but moderate, long-term, positive effects. See Section 6.2.1 Effects Common to All Alternatives Regarding Estuary Restoration for more information.

Alternatives 1 and 2 are similar (see Section 6.2.1) in the proposed IPM treatments to control invasive plants and animals to promote and improve healthy native habitats for fish and wildlife; however, Alternative 2 is more encompassing. Under Alternative 1, there would be negligible to minor, long-term, positive effects from maintaining existing habitats utilizing the current IPM management priorities, partnerships, and techniques for habitat improvements.

Alternative 2 proposes the Refuge would actively seek new partnerships and strengthen existing partnerships to control priority invasive species within all habitats. The Refuge staff would focus on newly invading problematic plant and animal species while also expanding control efforts on existing infestations. Invasive species control efforts would be implemented, with systematic follow-up control efforts, mapping, resource monitoring, and follow-up control measures as necessary. This sequence of activities would provide moderate positive effects to wildlife by removing the invasive species and improving the health of the habitat over the long term.

Refuge staff would be watching for changes in State guidelines regarding the control of nonnative aquatic Japanese or Asian eelgrass and determine a course of action. The overall extent or degree of Japanese eelgrass infestation within the tidal open water and intertidal mudflat habitats inside the Refuge boundary is currently unknown. Under Alternative 2, staff would work with partners to identify the extent of the infestation. Partnerships would develop removal methods, map sites within the Refuge boundary, and implement effective aquatic plant control actions, with follow-up monitoring and necessary treatment. Invasive plant eradication would be localized, within the Refuge boundary, and would likely result in long-term positive effects on the native eelgrass beds and wildlife with the removal of invasive Japanese or Asian eelgrass. Results of the control efforts are expected to be quantifiable through active routine monitoring and mapping with staff and partners. Refuge wildlife would benefit extensively as native eelgrass beds would expand and offer forage and foraging areas for a variety of shorebirds and migrating waterfowl. Expanded and healthy native eelgrass beds offer benthic and water column invertebrates quality habitat for laying eggs. The effects of control measures would likely be positive in the short and long term with minor to moderate effects dependent on the overall size of the infestation.

The associated fieldwork of invasive plant control can temporarily cause fish and wildlife to move away and negligible habitat disturbances. Estuarine species dependent upon native habitats for foraging, prey, cover, and loafing benefit from invasive plant control. A conservative approach (using the least amount of herbicides practical to achieve results) with the application of herbicides to eliminate the invasive plant would result in minor to moderate short-term effects from chemical exposure and negligible long-term effects. Long-term negative effects are not expected, instead effects would likely be localized and minor with a positive effect on fish and wildlife as their respective habitats would be in healthier condition to support each species group.

Refuge management would place a greater focus on managing invasive species on Refuge specific habitats while continuing partnerships throughout the estuary. The effects would be a moderate, long-term habitat enhancement over the current conditions. The effects of the above actions to remove invasive plants would specifically improve the intertidal mudflat habitat (native eelgrass beds), salt and brackish marsh habitats. A variety of species directly affected by these proposed actions all rely on a healthy intertidal mudflat habitat, salt and brackish marsh habitats, and forest habitats to provide high-quality food, cover, resting, loafing, and for some species, nesting areas. A variety of species utilizing the Refuge would benefit from invasive species management, including dabbling and diving ducks; geese; waterbirds such as loon, cormorant, brown pelicans; marshbirds such as herons and rails; shorebirds and other wading bird species; gulls and terns; raptors; and passerines. Invertebrate and fish species are expected to respond positively to invasive species management, especially when the habitat becomes a more diverse assemblage plant species.

Effects of Visitor Services Actions

Currently, all public access on the Refuge is located on the boardwalk trails, the Sandpiper Trail, and the Red Knot Spur. These trails provide visitors with high-quality shorebird viewing and photography opportunities while protecting sensitive estuarine habitats. Disturbance associated with visitation and participation in programs such as wildlife observation, photography, and environmental education would have negligible long-term effects because birds and animals have shown habituation to human presence on and around the existing Refuge boardwalk.

Alternative 2 proposes several new construction projects, the Red Knot Spur Trail (250-foot extension) and three new observation platforms to view estuarine habitats. As proposed, these facilities would provide additional opportunities to observe and photograph wildlife and would result in less congestion during peak migration periods and special events. During construction of the proposed facilities, minor short-term disturbance to wildlife would likely occur at the worksite. The pin foundation is expected to be used for the proposed structures. It was used on the original boardwalk and has been found to have a negligible short-term effect on the habitat. Construction timing would be limited to nonsensitive times such as nonshorebird migration and nonpasserine nesting periods. Long-term loss of habitat would be minimal because of the small footprint of the projects.

Alternative 2 also identifies and increases the Refuge's outreach and education efforts for the local and visiting public through a variety of projects, including directional signage, interpretive panels, education programs, electronic and print media, and other techniques. Combined with the additional visitor services facilities, these projects could have an indirect neutral to minor beneficial effect in the long term by increasing public awareness and helping to foster a sense of appreciation for the Refuge and the estuarine resources.

Overall Effects

Under Alternative 1, the Refuge would continue to protect the tidal open water, intertidal mudflats, and tidal salt and brackish marsh habitats. Staff would continue to implement IPM for protection of habitats. The effects from invasive species removal would be localized and short- and long-term effects would be minor to moderate (dependent on the level of infestation), providing improved habitats for wildlife.

Under Alternative 2, increases in IPM would help improve estuarine habitat structure, plant diversity, and native plant composition. Temporary localized disturbance and damage would have minor short-term effects. Fieldwork to do inventory, monitoring, and research may also cause negligible to minor short-term disturbances. However, enhanced habitat structure and composition would have moderate long-term beneficial effects for fish and wildlife, especially shorebirds. Minor, short-term negative effects on wildlife would occur with additional boardwalk and viewing platform construction in the salt marsh habitat. In the long term, negligible direct effects are expected from the new facilities.

Overall, habitat management actions under Alternative 2 represent a minor to moderate positive effect to both estuarine habitat quantity and quality for associated species. This more than offsets the negligible to minor negative effects and short-term effects on habitats or associated wildlife resulting from additional visitor service actions. Visitor services programs could have indirect minor to moderate long-term beneficial effects as visitors learn more about habitat and wildlife conservation.

6.2.5 Effects to Forest Habitat and Associated Species at Grays Harbor National Wildlife Refuge

Effects of Habitat Management Actions

Alternatives 1 and 2 are similar, except in Alternative 2 additional effort would be made to create partnerships to control nonnative, invasive knotweed on the north side of the Refuge. The Refuge would actively seek new partnerships and strengthen existing partnerships to control knotweed and to stay abreast of newly developing problematic species that may invade the forest habitat. The Refuge would continue to work with Grays Harbor Noxious Weed Control Agency, Grays Harbor PUD, Grays Harbor County, State agencies, and others to assure the highest priority species are addressed.

Minor, long-term, positive effects of habitat management are anticipated. Active and collaborative control of aggressive invasive plant species enables native species to outcompete for resources and improves the quality of the forest habitat. The vegetative transition to a native successional stage with equitable vertical structure provides improved forage, cover, and nesting opportunities for a diversity of resident and migratory bird species, including songbirds, raptors, small mammals, black-tailed deer, reptiles, amphibians, and invertebrates.

Effects of Visitor Services Actions

The existing boardwalk has negligible effect on the habitat and with time, the surrounding vegetation has formed a natural blind that minimizes human-induced disturbance to wildlife while increasing the quality of the wildlife observation experience to visitors. The additional observation platforms and a 250-foot extension of the Red Knot Spur trail under Alternative 2 would have short-term effects during construction; however, the design, timing, and placement of this new structure would incorporate factors to decrease negative short- and long-term effects on wildlife and habitat.

Overall Effects

In summary, Alternative 1 has negligible effect and the use of the specified habitat management techniques of Alternative 2 would help maintain and improve forest habitat structure, plant diversity, and native plant composition by removing invasive plant and animal species. Minor, temporary, localized disturbance could occur as a result of using these habitat management techniques, but these

effects would be temporary and shortly eclipsed by enhanced habitat structure and composition. Overall, wildlife management actions under Alternative 2 represent a minor to moderate positive effect to both forest habitat and quality for associated species.

Considering visitor services, the long-term effect of these minor human disturbances would have a negligible impact to migratory and resident forest wildlife and may be balanced by the long-term beneficial effect of using boardwalks to prevent trampling of habitats and indirect minor to moderate long-term beneficial effects regarding visitor education on habitat and wildlife conservation. The overall effect may represent a minor positive effect forest habitat and migratory and resident forest wildlife.

6.2.6 Effects to Threatened and Endangered Species at Grays Harbor National Wildlife Refuge

Effects of Habitat Management Actions

It is the policy of the Service to protect and preserve all native species of fish, amphibians, reptiles, birds, mammals, invertebrates, and plants and their habitats, that are designated federally threatened or endangered. Listed species receive special consideration in terms of Refuge management. Federally listed species are trust resources that require additional consultation whenever an activity conducted by or permitted by the Refuge may have an effect on these species or their habitats.

Currently, federally listed anadromous green sturgeon, eulachon, and bull trout all pass through the greater Grays Harbor estuary twice in their lifetime (see Chapter 4). These listed fish are thought to seasonally use eelgrass beds, salt marshes, intertidal mudflats, and open water habitats of the Refuge. Information regarding probable fish use of Refuge habitats has been garnered from surveys conducted near the Refuge (see Chapter 4. Section 4.4.1 Major Species Groups and 4.5 Threatened, Endangered, and Sensitive Species).

Common to both alternatives, salt marsh restoration with berm removal would result in negligible to minor short-term negative effects but minor to moderate long-term positive effects. See Section 6.2.1 Effects Common to All Alternatives Regarding Estuary Restoration for more information.

Discussions regarding effects on fish and wildlife species from habitat management are assessed in Section 6.2.4, and impacts associated with the use of herbicides and pesticides are assessed in depth in Appendix G. Disturbances from invasive plant control may temporarily cause listed fish to move away from the worksite. A conservative approach with herbicides and BMPs would result in minor, long-term, positive effects to the habitats. Long-term effects to habitats would be expected to be beneficial to listed fish dependent upon healthy native estuarine habitats for foraging, prey, cover, and loafing.

As part of both alternatives, an Inventory and Monitoring Plan would be developed to guide needed baseline data, ongoing monitoring, and research to enhance habitat and species management of the Refuge or the greater estuary. Threatened and endangered species seasonality, needs, and tolerances will be explored and taken into account during the planning and implementation processes.

Effects of Visitor Services Actions

As explored in the Compatibility Determinations (Appendix B), wildlife observation, photography, interpretation, and environmental education activities would not likely pose impacts to these threatened and endangered species in Alternative 2. Visitor activities and access are not conducted within the estuarine or marsh habitats.

Overall Effects

Overall, under Alternative 1, minor, long-term, positive effects are expected on federally listed anadromous green sturgeon, eulachon, and bull trout and on their habitats as native habitats are restored and enhanced. Due to the increases in IPM and habitat improvements, under Alternative 2, minor to moderate, long-term, positive effects are expected to listed species.

6.2.7 Effects to Visitor Services at Grays Harbor National Wildlife Refuge

Welcoming visitors and providing opportunities for compatible wildlife-dependent activities such as wildlife observation, interpretation, wildlife photography, and environmental education are important parts of the National Wildlife Refuge System.

Effects of General Social Environment Actions

Several general social effects apply across the visitor services program and are not tied to specific wildlife-dependent recreation and education opportunities. Refuge management can influence the number of visitors. Refuge decisions about features of visitor services management—such as how many facilities to build, where to build those facilities, how much staff time to devote to programs, and how much parking to provide—all may influence visitation for years to come. Similarly, and often playing a greater role, demographic shifts, cultural preferences, and economics influence Refuge visitation. Even small annual shifts in visitation can have a profound effect over time.

Under Alternative 1, visitation is anticipated to remain at approximately the same level as the 2011 baseline. Under Alternative 2, the proposed increases in visitor opportunities, expanded outreach and information, enhanced environmental education program, new facilities (boardwalks and viewing areas), new communication tools, and general rising interest in the Refuge would increase visitation in the next 20 years by 20–40 percent, from 15,572 (2011) to approximately 21,750 visitors per year.

Increased contact with the public provides an opportunity for better visitor understanding and subsequent support of the Refuge and the Refuge System. Improvement of existing visitor facilities would lead to safer, more comfortable visitor experiences. On the other hand, increased visitation may lead to crowding at times such as weekends and during spring shorebird migration when visitation tends to be greatest. This could lead to a slight long-term negative effect to the quality of individual visitor experiences or may have a slightly beneficial effect for visitors exposed to the contagious excitement of seeing large numbers of shorebirds.

The overall general social effects would be minor to moderately positive for visitors. See remaining sections of Chapter 6 and Appendix B for more detailed analysis of wildlife-dependent recreation and education activities.

Effects of Facilities

Under Alternative 1, the Refuge would maintain the current 4,000-square-foot storage building (Map 1). Under Alternative 2, the Refuge storage facility would be converted to a Refuge maintenance shop. The building and parking footprint would not be expected to increase in size, therefore conversion to a maintenance shop and use of the building on a regular routine basis would cause negligible, long-term effects on habitat and wildlife; however, the new maintenance shop would benefit habitat management and trail and visitor facility maintenance programs and could lead to indirect, positive social effects.

As described within Section 6.2.1 Effects Common to All Alternatives Regarding Nature Center and Other Facilities Planning, further assessments of effects related to potential new visitor services facilities would be conducted in the future in association with more detailed planning and design, and, as appropriate, as part of a separate NEPA process and document.

Overall Effects

Overall impacts involving the visitor services program would offer a long-term positive improvement in the amount of onsite environmental education and wildlife-dependent recreation opportunities available to visitors on the north side of the greater Grays Harbor estuary. Priority visitor opportunities would increase and improve with the establishment of new information facilities and access. These improvements may also help address potential adverse effects to the habitat that may result as the human population and Refuge visitation increases; boardwalks and kiosks would aid in directing visitors to areas with minimal impacts to the habitat and wildlife.

6.2.8 Effects to Opportunities for Quality Wildlife Observation, Photography, Interpretation, and Environmental Education Experiences at Grays Harbor National Wildlife Refuge

Effects of Habitat Management Actions

Alternative 1 has negligible effects from existing habitat management. Alternative 2 provides an increase in the number of improved acres of habitat from invasive species treatment relative to Alternative 1. Through habitat management projects these improvements would likely result in enhanced opportunities to observe a variety of shorebirds, passerines, waterfowl, marshbirds, raptors, small mammals, insects, native wildlife, and native plants. There may be some negative short-term effects to the visitor experience as various habitat management actions are implemented but these are expected to be temporary and negligible and result in beneficial long-term effects.

Effects of Visitor Services

Currently, visitors concentrate on existing boardwalks and pull-out observation platforms. Alternative 2 provides a moderate increase in nonconsumptive recreational opportunities from increased boardwalks and viewing facilities, increased interpretation, and educational programs. Environmental education opportunities would be enhanced with a strong emphasis on partnerships, staffing, and volunteers (see Chapter 2. Goal 5). These additions would result in minor modifications of some habitats; these are discussed in the Effects from Facilities section in Section 6.2.7.

Alternative 2 provides increased efforts to reach visitors through additional signage, interpretive panels, electronic and print media, social networking, and other techniques that are expected to raise awareness of Grays Harbor NWR and what it has to offer. These proposed efforts to reach visitors would have negligible negative effects on fish, wildlife, or habitats and would have moderate short- and long-term beneficial effects for the public.

Overall Effects

Overall, implementing Alternative 2 would result in a minor to moderate beneficial, long-term improvement in the amount of opportunities for quality wildlife observation, photography, interpretation, and environmental education experiences available to the public. Priority public use opportunities could increase and would improve with the establishment of new public information and access. These improvements would also help address the adverse effects that may result as the human population continues to increase in the region and visitation grows over time. Long-term, beneficial effects would occur for visitors as increased opportunities to enjoy quality wildlife observation, photography, interpretation, and environmental education would exist under Alternative 2.

6.2.9 Effects to Cultural Resources at Grays Harbor National Wildlife Refuge

The Service is committed to protecting known cultural resources under both alternatives. Upland areas of the Refuge were former dump sites for dredge spoil, and cultural resources are not expected to be onsite. However, prior to implementing ground-disturbing projects, the applicable cultural resource compliance investigation would be undertaken. If cultural resources were found, appropriate procedures and protocols would be followed to protect them. Whenever possible, resources would be avoided or mitigated. Mitigation options, in addition to site avoidance by relocating or redesigning facilities, would include data recovery, using either collection techniques or in-situ site stabilization protection.

Native vegetation of cultural value such as sweetgrass, used in tribal basket weaving, would be monitored and managed to keep plant health stable as much as possible. However, sweetgrass is most likely going to be negatively affected by sea level rise over time.

Overall Effects

Compliance with cultural resource investigation protocols prior to conducting ground-disturbing actions, and subsequent compliance with procedures if cultural resources are found, would ensure that negative impacts to cultural resources from implementation of any of the alternatives are negligible.

6.2.10 Effects to the Economy at Grays Harbor National Wildlife Refuge

Refuge CCP planning includes a regional economic analysis as a way of estimating how current management (No Action – Alternative 1) and proposed management activities (Preferred Alternative – Alternative 2) would affect the local economy. This type of analysis provides two critical pieces of information: it illustrates a refuge's contribution to the local community, and it can help determine whether economic effects are a real concern in choosing between the management alternatives.

From an economic perspective, both Grays Harbor NWR and the Black River Unit of Billy Frank Jr. Nisqually NWR provide a variety of environmental and natural resource goods and services used by people either directly or indirectly. The use of these goods and services result in economic impacts to both local and state economies. The various services that refuges provide can be grouped into five broad categories: (1) maintenance and conservation of environmental resources, services, and ecological processes, (2) production and protection of natural resources such as fish and wildlife, (3) protection of cultural and historical sites and objects, (4) provision of educational and research opportunities, and (5) compatible outdoor and wildlife-dependent recreation. People who use these services benefit in the sense that their individual welfare or satisfaction level increases with the use of a particular good or service.

One measure of the magnitude of the change in welfare or satisfaction associated with using a particular good or service is economic value. Economic value is the economic trade-off people would be willing to make in order to obtain some good or service. It is the maximum amount people would be willing to pay in order to obtain a particular good or service minus the actual cost of acquisition. In economic theory this is known as net economic value or consumer surplus. In the context of this chapter, estimates of the economic value of particular recreational activities are used to determine the aggregate value of recreational use of Grays Harbor NWR and Black River Unit.

Use of the good or service usually entails spending money in some fashion. These expenditures, in turn, create a variety of economic effects collectively known as economic impacts. Economic impacts refer to employment, employment or labor earnings, economic output, and Federal, local, county, and State tax revenue that occur as the result of refuge activities. These impacts are analyzed using IMPLAN, a regional input-output model and software system. The following is a list of terms and definitions that are commonly used in economic impact analysis (Minnesota IMPLAN Group, Inc. 2004 and Miller and Blair 1985).

> *Economic output* includes three types of effects: direct, indirect, and induced. Direct effects are the expenditures associated with a particular activity (such as refuge recreation visits and management activities). Indirect effects result from changes in sales for suppliers to the directly affected businesses (including trade and services at the retail, wholesale, and producer levels). Induced effects are associated with further shifts in spending on food, clothing, shelter and other consumer goods and services as a consequence of the change in workers and payroll of directly and indirectly affected businesses (Weisbrod and Weisbrod 1997). The indirect and induced effects represent any multiplier effects. Both job income and tax revenue are derived from total economic output (aggregate sales). For example, labor costs are paid out of total sales revenue for a company, as are taxes. To add taxes and job income to output would double-count economic impacts.
>
> *Jobs* and *job income* include direct, indirect, and induced effects in a manner similar to economic output. Employment includes both full- and part-time jobs, with a job defined as one person working for at least part of the calendar year, whether one day or the entire year.
>
> *Tax revenue* is shown for business taxes, income taxes, and a variety of taxes at the local, state, and national level. Like output, employment, and income, tax impacts include direct, indirect, and induced tax effects.

A comprehensive economic profile (baseline) of a refuge and estimates of the economic effects of alternative management strategies would address all applicable economic effects associated with the

use of refuge-produced goods and services. However, for those goods and services having nebulous or non-existent links to the market place, economic effects are more difficult or perhaps even impossible to estimate. Some of the major contributions of a refuge to the natural environment, such as watershed protection, maintenance and stabilization of ecological processes, and the enhancement of biodiversity require extensive onsite knowledge of biological, ecological, and physical processes and interrelationships to begin to formulate economic benefit estimates. This is beyond the scope of this analysis.

This section focuses on a limited subset of refuge goods and services, primarily those directly linked in some fashion to the marketplace, such as recreation use and refuge budget expenditures. It should be kept in mind that the emphasis on these particular market-oriented goods and services should not be interpreted to imply that these types of goods and services are somehow more important or of greater value (economic or otherwise) than the non-market goods and services previously discussed.

Two types of economic impacts are addressed: (1) impacts associated with annual consumer expenditures on refuge-related recreation and (2) impacts associated with refuge budget expenditures. The economic impacts are presented as annual impacts over a 15-year time period. For Alternative 2, the analysis presents the impacts that would result assuming that all management objectives are implemented and achieved. Note that funds are not currently present to implement all objectives and strategies identified; however, the analysis for Alternative 2 represents the funding that would be manifested if implemented.

Two types of information are needed to estimate the economic impacts of recreational visits to a refuge: (1) the amount of recreational use on the refuge by activity; and (2) expenditures associated with recreational visits to the refuge. Recreational use (i.e., visitation and the distribution of resident visitors and non-resident visitors) was estimated by Refuge Complex staff. Expenditure patterns were obtained from the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (U.S. Department of the Interior et al. 2007). These expenditures include travel-related expenses, such as food, lodging, transportation, and other travel-related miscellaneous expenses. With this information, total expenditures for each activity can be estimated. These expenditures, in turn, can be used in conjunction with regional economic models to estimate industrial output, employment, employment income and tax impacts associated with these expenditures. For Grays Harbor NWR, the economic impact area for recreational activities is defined as Grays Harbor County, which is located in the southwest of the state of Washington. For Black River Unit, the economic impact area for recreational activities is defined as Thurston County, which is located at the southern tip of Puget Sound in Washington. It is assumed that visitor expenditures occur primarily within these areas. The economic impacts from recreation expenditures estimated in this chapter are gross area-wide impacts. Information on where expenditures may occur locally and the magnitude and location of resident and non-resident expenditures (resident and non-resident relative to the geographical area of interest) is not currently available. Generally speaking, non-resident expenditures bring outside money into the area and thus generate increases in real income or wealth. Spending by residents is simply a transfer of expenditures on one set of goods and services to a different set within the same area. In order to calculate net economic impacts within a given area derived from resident expenditures, much more detailed information would be necessary on expenditure patterns and visitor characteristics. Since this information is not currently available, the gross area-wide estimates are the maximum impact for the net economic impacts of total resident and non-resident spending in Grays Harbor County (for Grays Harbor NWR) and Thurston County (for Black River Unit). The economic impacts of non-resident spending represent a real increase in wealth and income for the area (for additional information, see Loomis p. 191, 1993).

Recreational Activities

The Refuge receives visitors from across the United States; however, a majority of visitors live in the local area. The spending by recreational visitors when visiting the Refuge influences the local economy by creating jobs and generating tax revenue.

Alternative 1 (Current Management): Recreational Activities

Under Alternative 1, there would be no changes to the recreational activities offered at the Refuge. All programs would continue to follow current management goals. Grays Harbor NWR would continue to offer a variety of nonconsumptive public uses, including wildlife observation, photography, interpretation, and environmental education.

Table 6-3 shows the visitation for Grays Harbor NWR. The Refuge had 11,550 recreation visits in 2011. Pedestrian visits represented 91 percent of all visits. In addition to recreation visits, the Refuge also had about 4,022 environmental education visits, leading to a total visitation of 15,572.

Table 6-3. Grays Harbor NWR FY2011 Visitation

Activity	Residents	Nonresidents	Total
Nonconsumptive			
Pedestrian	7,875	2,625	10,500
Auto Tour	0	0	0
Boat Trail/Launch Visits	0	0	0
Bicycle Visits	0	0	0
Photography	750	250	1,000
Other Recreation	0	0	0
Interpretation	0	50	50
Environmental Education	4,022	0	4,022
Hunting			
Waterfowl	0	0	0
Other Migratory Birds	0	0	0
Upland Game	0	0	0
Big Game	0	0	0
Fishing			
Freshwater	0	0	0
Saltwater	0	0	0
Total Visitation	12,647	2,925	15,572

Regional Economic Analysis

Visitor recreation expenditures for Alternative 1 are shown in Table 6-4. Environmental education opportunities for residents do not contribute to the local economic impacts because the events

typically do not bring visitors who are spending money toward travel-related goods and services. Total annual expenditures were about $83,300 with nonresidents accounting for about $46,100, or 55 percent, of total expenditures. Under Alternative 1, these annual expenditures are expected to continue.

Table 6-4. Grays Harbor NWR Alternative 1: Visitor Recreation Expenditures (2011 dollars in thousands)

Activity	Residents	Nonresidents	Total
Nonconsumptive	$37.30	$46.10	$83.30
Hunting	–	–	–
Fishing	–	–	–
Total Expenditures	$37.30	$46.10	$83.30

Input-output models were used to determine the economic impact of expenditures on the Refuge's local economy. It is assumed that visitor expenditures occur primarily within Grays Harbor County. Table 6-5 summarizes the local economic effects associated with recreation visits. Economic output totaled $108,600 with associated employment of one job, $32,200 in employment income, and $7,400 in total tax revenue.

Table 6-5. Grays Harbor NWR Alternative 1: Local Economic Effects Associated with Recreation Visits (2011 dollars in thousands)

	Residents	Nonresidents	Total
Economic Output	$49.80	$58.80	$108.60
Jobs	0.50	0.60	1
Job Income	$14.80	$17.40	$32.20
State & Local Tax Revenue	$3.30	$4.20	$7.40

Alternative 2: Recreational Activities

Table 6-6 shows the visitation that would occur if Alternative 2 were fully implemented. Approximately 22,000 visits would be related to a variety of wildlife-dependent opportunities, interpretation programs, and environmental education. Pedestrian visits would continue to represent the majority of all visits. In addition to recreation visits, the Refuge also would support 4,400 environmental education visits.

Under Alternative 2, visits are projected to increase by 40 percent, compared to Alternative 1. Similar to Alternative 1, all visitors would participate in nonconsumptive activities.

Table 6-6. Grays Harbor NWR Alternative 2: Projected Annual Refuge Visitation

Activity	Residents	Nonresidents	Total
Nonconsumptive			
Pedestrian	11,025	4,725	15,750
Auto Tour	0	0	0
Boat Trail/Launch Visits	0	0	0
Bicycle Visits	0	0	0
Photography	1,050	450	1,500
Other Recreation	0	0	0
Interpretation	10	90	100
Environmental Education	4,400	0	4,400
Hunting			
Waterfowl	0	0	0
Other Migratory Birds	0	0	0
Upland Game	0	0	0
Big Game	0	0	0
Fishing			
Freshwater	0	0	0
Saltwater	0	0	0
Total Visitation	16,485	5,265	21,750

Regional Economic Analysis

Visitor recreation expenditures associated with a fully implemented Alternative 2 are shown in Table 6-7. Total annual expenditures would be about $200,000 with nonresidents accounting for about $122,000, or 61 percent, of total expenditures. Expenditures associated with nonconsumptive activities would account for all expenditures.

Table 6-7. Grays Harbor NWR Alternative 2: Visitor Recreation Expenditures (2011 dollars in thousands)

Activity	Residents	Nonresidents	Total
Nonconsumptive	$77.30	$122	$199.20
Hunting	–	–	–
Fishing	–	–	–
Total Annual Expenditures	$77.30	$122	$199.20

Input-output models were used to determine the economic impact of expenditures on the Refuge's local economy under Alternative 2. The estimated economic impacts are expected to occur in Grays Harbor County. Table 6-8 summarizes the local economic effects associated with recreation visits.

Under Alternative 2, economic output would total $258,800 with associated employment of three jobs, $76,800 in employment income, and $17,800 in total tax revenue.

Table 6-8. Grays Harbor NWR Alternative 2: Local Economic Effects Associated with Recreation Visits (2011 dollars in thousands)

	Residents	Nonresidents	Total
Economic Output	$103.11	$155.70	$258.80
Jobs	1	2	3
Job Income	$30.75	$46	$76.80
State & Local Tax Revenue	$6.76	$11	$17.80

Alternative 2: Summary of Recreational Visitation Impacts

Table 6-9 provides a summary of the potential economic impacts related to recreational visitation for each alternative. Under Alternative 2, recreation visitation would increase after the management alternative is fully implemented. As a result, economic output, jobs, job income, and tax revenue would increase.

Table 6-9. Annual Economic Effects Associated with Recreation Visits (2011 dollars in thousands)

	Alternative 1	Alternative 2
Recreation Visits	11,550	17,350
Expenditures	$83.30	$199.20
Economic Output	$108.60	$258.80
Jobs	1	3
Job Income	$32.20	$76.80
State & Local Tax Revenue	$7.40	$17.80

Refuge Budget

Annual costs reflect Refuge spending of base funds allocated each year. These are also known as recurring costs and are usually associated with day-to-day operations. Nonsalary expenditures are primarily operational costs including fuel, administrative costs, brochures, utilities, operation of the Grays Harbor Shorebird and Nature Festival, boardwalk and trail maintenance, invasive plant monitoring and control, and visitor services programs, including environmental education.
Table 6-10 shows the average annual expenditures would be about $74,000 for Alternative 1 and $738,000 for Alternative 2. The estimated expenditures for Alternative 2 assume that the alternative is fully funded as described in the CCP. Increased needs identified for Alternative 2 include eight additional full time employees (FTEs), existing building operational and maintenance costs, a new building operation and maintenance costs, nature center-associated programs, an enlarged visitor services program, increased invasive plant monitoring and control work, and habitat management, among other increased programs.

Table 6-10. Grays Harbor National Wildlife Refuge Average Annual Expenditures (2011 dollars in thousands)

Expenditure	Alternative 1	Alternative 2
Salary	$49.10	$570.60
Nonsalary	$25.10	$167.70
Total	$74.20	$738.30

Table 6-11 shows the economic impact of average annual (salary and nonsalary) expenditures. Impacts associated with annual expenditures would continue to occur throughout the 15-year timeline of the CCP if the alternative is fully funded. Under Alternative 1, the Refuge's annual expenditures would generate approximately $53,300 in economic output, one job, $23,700 in job income, and $2,700 in tax revenue. Annual expenditures under Alternative 2 would generate economic output of about $517,900, five jobs, $207,900 in job income, and $28,500 in total tax revenue.

Table 6-11. Local Annual Economic Effects Associated with Average Annual Refuge Budget (2011 dollars in thousands)

	Alternative 1	Alternative 2
Economic Output	$53.30	$517.90
Jobs	1	5
Job Income	$23.70	$207.90
State & Local Tax Revenue	$2.70	$28.50

Revenue Sharing Payments

Under provisions of the Refuge Revenue Sharing Act (Public Law 95-469), the Service would annually reimburse Grays Harbor County for tax revenue which is lost as a result of the Service's acquisition of private property. This law states that the Secretary of the Interior (Secretary) shall pay to each county in which any area acquired in fee title is situated, the greater of the following amounts:

- An amount equal to the product of 75 cents multiplied by the total acreage of that portion of the fee area that is located within such county.
- An amount equal to three-fourths of one percent of the fair market value, as determined by the Secretary, for that portion of the fee area that is located within such county.
- An amount equal to 25 percent of the net receipts collected by the Secretary in connection with the operation and management of such fee area during such fiscal year. If a fee area is located in two or more counties, however, the amount for each county shall be apportioned in relationship to the acreage in that county.

The appraisal estimate value is based on the current local land values at the time of the appraisal. The Refuge Revenue Sharing Act payments to Grays Harbor County have averaged $3,135 annually from Fiscal Years 2011 to 2013.

Forecasting revenue sharing payments is complex. Actual payments are a function of the appraised value and appropriations. The Refuge Revenue Sharing Act requires Service lands be reappraised every 5 years to ensure that payments to local governments remain equitable. However, some payments are less than the legislated amounts due to governmental funding deficits. Congress may appropriate, through the budget process, supplemental funds to compensate local governments for any shortfall in revenue sharing payments. The final calculation for the payment to local governments depends on the total amount of funds available from revenue receipts collected on refuges nationwide and any appropriations. As a result, payments fluctuate based on the revenue receipts and appropriations. Due to the size of the revenue sharing payment, economic impacts would be negligible.

Overall Effects

This section summarizes the economic impacts generated by Refuge management activities for each alternative. Table 6-12 summarizes the economic impacts in Grays Harbor County for Alternative 1. Under Alternative 1, Refuge activities would generate an estimated $161,900 in economic output, two jobs, $55,900 in job income, and $10,100 in state and local tax revenue. These economic impacts under Alternative 1 would be negligible as they represent less than 1 percent of total income and total employment in the local area economy.

Table 6-12. Summary of Annual Economic Impacts for Alternative 1 (2011 dollars in thousands)

	Economic Output	Jobs	Job Income	State & Local Tax Revenue
Recreation Visits	$108.60	1	$32.20	$7.40
Budget	$53.30	1	$23.70	$2.70
Total	$161.90	2	$55.90	$10.10

Table 6-13 summarizes the economic impacts for Alternative 2. Under Alternative 2, Refuge activities would generate an estimated $776,700 in economic output, eight jobs, $284,700 in job income, and $46,300 in tax revenue. These economic impacts under Alternative 2 would also be negligible as they represent less than 1 percent of total income and total employment in the local area economy.

Table 6-13. Summary of Annual Economic Impacts for Alternative 2 (2011 dollars in thousands)

	Economic Output	Jobs	Job Income	State & Local Tax Revenue
Recreation Visits	$258.80	3	$76.80	$17.80
Budget	$517.90	5	$207.90	$28.50
Total	$776.70	8	$284.70	$46.30

One-time costs related to Refuge management were not taken into account in this analysis. However, large capital investments, such as the potential development of new facilities, would be expected to provide minor to moderate short- and long-term economic benefits. For example, if the 2007 nature center design is implemented, costs have been estimated at $6.18 million (June 2008 dollars). These direct expenditures would be expected to generate indirect and induced (i.e., multiplier) effects which would provide minor economic benefits to the local community.

6.2.11 Cumulative Effects at Grays Harbor National Wildlife Refuge

Effects of Reasonably Foreseeable Future Refuge Activities

Alterations and loss of native habitats continue at the landscape scale, and human development and climate change pose complex and persistent threats. The Refuge, although relatively small, may become increasingly valuable for the persistence of native wildlife. Active improvement of habitats would increase or maintain the value of Refuge lands and waters for a diversity of native fish and wildlife and would improve and maintain biological diversity. Both alternatives protect and maintain Refuge habitats valuable to wildlife; however, there is a greater emphasis on IPM and pursuing priority inventory, monitoring, and research needs in Alternative 2.

In concert with other protected lands, the Refuge has an important role to conserve resident, threatened, and rare species, as well as migratory wildlife species, and to provide places where the public can enjoy and experience nature. Additionally, the Service contributes to the regional availability and quality of wildlife-dependent recreational opportunities. Implementing the CCP would have overall beneficial effects to habitats, species, and the American public. In the context of all of the factors (both natural and human-caused) that negatively affect habitats and species (e.g., food availability, human disturbance, and contaminants) the positive contributions associated with CCP implementation represent a moderate, beneficial effect.

Other Reasonably Foreseeable Events and Activities from Others

Although the communities of Aberdeen, Hoquiam, and Westport, along the shores of the Grays Harbor estuary, have experienced an economic downturn, there is potential for recovery and associated growth. Any future growth and development of businesses and industries that use the estuary could stress the ecosystem through both direct and indirect loss. Habitat loss would be direct; indirect loss would result from fragmentation and degradation of the estuary fish and wildlife habitat and increasing demands on water.

Coal and oil industries are examples of business that would use the estuary. Currently there are two State Environmental Policy Act permit requests to increase oil storage and transfer facilities in Aberdeen/Hoquiam; these facilities would require deep channelization for large ships, which would change the sedimentation and turbidity of the estuary. Expansion of these facilities and transportation and storage of products would need to be evaluated for the potential impacts to the estuary and surrounding habitats. Incidents, both natural (severe storms, flooding, and sea level rise) and man-induced (spills) are potential impacts to the habitats on- and off-Refuge.

6.3 Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

6.3.1 Effects Common to All Alternatives at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Effects Common to All Alternatives from Integrated Pest Management (IPM)

Under both alternatives, the Unit would continue to control invasive species, but to varying degrees with respect to target species and acreage treated. IPM under Alternative 1 is minimal, with concerted efforts toward specific species (reed canarygrass, purple loosestrife, yellow flag iris) in patches, focusing on new establishments compared to a higher level of effort and resources that would be directed to invasive species under Alternative 2.

Mechanical, cultural, biological, and chemical control methods would be evaluated for eradication, control, or containment of invasive species in order to achieve resource management objectives (Appendix G. IPM). Pesticide chemical selection and usage will be subject to regionally reviewed State regulations, State and federally approved herbicides and adjuvants, Service-approved PUPs, and EPA's PGP. Pesticide chemical selection will also conform to the specific pesticide label requirements and be applied by licensed applicators. Service guidelines direct the Unit to use the most efficacious pesticide available with the least potential to degrade environmental quality (soils, surface water, groundwater, and air) as well as minimizing potential effect to native nontarget species. Additionally, adjuvants (an additive that increases herbicide effectiveness such as increasing adhesion to target plants) should have the least potential effect to native nontarget species.

Potential effects to the biological and physical environment are associated with the proposed site-, time-, and target-specific use of pesticides. PUPs on the Unit would be evaluated using scientific information and analyses documented in "Chemical Profiles" (see Appendix G). These profiles provide quantitative assessment/screening tools and threshold values to evaluate potential effects to species groups (birds, mammals, and fish) and environmental quality (water, soil, and air). Any pesticide use must be approved through a PUP. PUPs (including appropriate BMPs) would be approved where the Chemical Profiles provide scientific evidence that potential impacts to the Unit's biological resources and its physical environment are likely to be only minor, temporary, or localized in nature.

Based on scientific information and analyses documented in Chemical Profiles, most pesticides allowed for use on Unit lands and waters would be of relatively low risk to nontarget organisms as a result of low toxicity or short-term persistence in the environment. Thus, potential impacts to Unit resources and neighboring natural resources from pesticide applications would be expected to be minor, temporary, or localized in nature.

Some risks may still occur via factors not assessed under current protocols, such as intermingling of unlike chemicals in the field, species-specific sensitivity that differs from surrogate species sensitivity, exposure through inhalation, exposure through ingestion of pesticide-contaminated soil, and other factors (see Appendix G).

The effects of nonpesticide IPM strategies (e.g., mowing) to address pest species on the Unit would be similar to those effects described elsewhere in this chapter, where they are discussed specifically as habitat management techniques to achieve resource management objectives on the Unit.

The associated fieldwork of invasive plant control can temporarily cause wildlife to move away and slight habitat disturbances. Invasive species may be spread by moving equipment from site to site. These species may also become established where soils and existing plant cover is disturbed. The refuge equipment operators would be required to clean equipment before moving between sites to reduce the spread of seeds and plant parts. The Unit would continue to monitor habitats for invasive weeds, aggressively control invasive plants, and restore sites to vegetation with high wildlife value. If mechanical methods are not expected to be effective or would have undesirable consequences such as the destruction of desirable vegetation that is interspersed with weed species, then the Unit may decide to use an herbicide. Employment of a conservative approach with herbicides would result in minor, localized, short-term negative effects and negligible long-term effects from chemical exposure. Long-term negative effects are not expected, instead the effects should be positive on fish and wildlife as their respective habitats would be in better condition to support each species group.

Effects Common to All Alternatives from Prescribed Fire

Under both alternatives, prescribed fire is listed as one of the available IPM strategies (Obj. 1.6, 1.7, 2.1). If utilized, objectives may include (1) maintenance of ecological processes, specifically by retarding succession in sites where woody shrub or tree invaders are present; (2) maintenance of vigorous stands of native grasses and forbs; (3) providing open spaces that increase landscape diversity; and/or (4) reducing or maintaining the density of nonnative species.

The effects of prescribed fire are relative to ecosystem condition, season (fuel and soil moisture), and the characteristics of the ignited fire. In stands with invading woody shrubs or trees, restoration fires are often more intense so that they injure and kill invading species. In stands with substantial nonnative species present, single fires can have no effect or even stimulate regrowth in nonnative species (DiTomaso et al. 2006, Keeley 2006). With repeated prescribed fires, particularly those that target sensitive phenological stages (peak vegetative stage or prior to seed dispersal), many nonnative herbs and invading shrubs tend to decline (DiTomaso et al. 2006).

Immediately after a prescribed fire, there is an immediate reduction in prey for ground- and aerial-foraging species, especially those that prey on invertebrates. There is the potential for direct mortality of surface-dwelling and ground-nesting species if fire occurs during breeding season. Nesting habitat for ground-nesting species would be completely removed. Burrowing species would be minimally directly affected by surface fires. Direct mortality for large mammals is not expected to occur for prescribed fires in grassland habitat. These fires are relatively quick-moving, but the ample sight distances would allow animals to react in time to reach safety. All large mammals would incur some stress from flight and avoidance behaviors along with temporary displacement from home ranges. Studies associated with landscape-scale fires indicate that most large mammals do not appear to be substantially affected (Smith 2000). Effects to predators would be similar to the large mammals. Predators can also suffer from increased competition if they are forced to migrate to already occupied home ranges of other predators. There would be limited impacts to reptile and amphibian species and individuals with access to suitable escape habitat (wetlands, burrows, or large unburned fuels). It has been suggested that most reptile and amphibian species are relatively unaffected by prescribed fire and there is limited mortality (Russell et al. 1999). Some mortality to other species and individuals would be expected depending on duration and intensity of the fire. The effect of prescribed fire on

invertebrates depends on the life-stage of the species of concern when the fire occurs and fire intensity. Some mobile forms that can fly or otherwise escape a burn would be minimally affected; however, others may not be able to escape a fast-moving fire. Those life stages that are immobile (e.g., eggs, larvae, or pupae) and exposed to the fire would be expected to suffer a higher rate of mortality. High-intensity fires can result in soil heating to the level where invertebrates found in the near-surface soils are killed (Nealy et al. 1999). Temperatures rapidly decline below the surface, so insects found in the soil would be less affected than terrestrial species when burn intensities are relatively low.

In the short term (i.e., next growing season), grasslands would be expected to rapidly regenerate in the spring following the burn; however, vegetative forage in wetland areas would likely continue to be reduced from pre-burn levels. Winter rainfall would allow the existing seedbank to germinate. In turn, this would provide forage for species that graze on the vegetation. Predators could improve hunting success because of improved visibility, but conversely could also suffer from lower small mammal abundance. Granivores would find limited food sources until late in the summer when grasses matured. Much of the burn area would be unsuitable as nesting habitat for those species that require dense grass cover for their nests; however, those species that prefer more open habitat may find somewhat improved nesting habitat. Overall, there would be a reduction in habitat for ground-nesting species caused by removal of the vegetation which formerly provided cover. There would be a reduction in habitat for small mammals that require dense cover. Conditions would gradually improve as the vegetation regrew through the growing season. There may be a limited amount of seed-based forage until summer, but most species would benefit from increased herbaceous production. The increased production of forage typically increases large mammal use of burned sites. Depending on the season of fire, recolonization can occur almost immediately after the fire is extinguished (Smith 2000). Predators would be expected to follow the prey back into the area. Until the prey base is available to support them, recolonization by herbivores and small mammals may be slower and in lower numbers than were present before the fire. Because reptile and amphibian mortality is expected to be minimal, an extensive and slow recolonization would generally not be required. However, similar to small mammals, the removal of tall grass and ground litter that formerly provided cover would limit habitat suitability, at least in the early part of the growing season. Species that rely on these habitats may be slow to recolonize as this material reaccumulates post-burn (Russell et al. 1999). For invertebrates, recolonization is expected from adjacent unburned areas through natural dispersal methods as forage and egg-laying habitat regenerates during the first growing season. Species with life stages that occur within the soil would be affected to a lesser degree.

In the long term, overall there would be a beneficial effect to birds as native forage became reestablished, invasive species were reduced, and the vegetation was maintained as a native-dominated community and free of encroaching shrubs, trees, and invasive plant species. Because they rapidly regenerate, grasslands may reach pre-burn conditions in only a couple of growing seasons. Wetter areas would return to pre-fire conditions somewhere between 5 and 20 years, depending on the community and management actions, especially periods and depths of inundation. The increased production of native ground cover would be expected to support target native wildlife species.

The following measures could reduce the negative effects of prescribed fire on wildlife and encourage faster recovery. These measures are conceptual and some could conflict. Measures that are applicable to a specific fire plan would need to be adjusted to the local conditions. Measures to minimize harm to these species include:

1. To minimize direct mortality, conduct prescribed fire outside the nesting and calving or fawning period for birds and large mammals.
2. Conduct surveys for priority resources of concern to document locations and areas of use, allowing for more accurate fire planning and thereby minimizing adverse effects.
3. To minimize direct mortality to focal species of invertebrates, conduct burns during the underground life-stages, or during the flight period.
4. Minimize indirect effects to amphibian breeding areas and waterways by protecting them with erosion control measures that restrict sediment-laden water from entering wetlands and ponds.

Because of the short residence times, low fuel loads, and patchiness of fuels, few concerns exist over soil heating in most Pacific Northwest dry grasslands and wetlands (Walstad et al. 1990). Removal of larger woody material may be prescribed through cut-and-pile treatments. The effects of pile burning on underlying soil heating are well-studied and reviewed elsewhere (DeBano et al. 1998). In short, piles can generate substantial heat and combust soil organic matter, alter soil structure, and increase the hydrophobic nature of underlying mineral soil. Pile burning can also lead to subsequent nonnative species invasion in areas of localized soil disturbances. In even heavily encroached grasslands, piles typically cause only minor, patchy effects (piles typically cover less than 5 percent of the burned landscape). If pile burning is required, minimization measures could include scattering severity across the landscape with small piles ignited conservatively or removing slash from units prior to burning. Pile burning effects can also be minimized if the small piles are burned over wet soil (during the dormant season), where the soil moisture will resist temperature rise (DeBano et al. 1998). Pile burning locations may require focused follow-up to prevent nonnative species establishment.

Impacts to air quality would occur from the actual burning activities and also from emissions associated with equipment used to facilitate and manage the prescribed burn for fire control purposes. Emissions associated with equipment for prescribed burning are assumed to be minimal in comparison with the emissions associated with the actual prescribed burn. Through effective planning and methods by which prescribed burns are controlled, emissions associated with prescribed burns can be limited to such a degree that ambient air quality standards are not exceeded, and impacts would be adverse but not significant. Additionally, properly planned and executed prescribed fire can reduce the frequency and intensity of wildfire, thereby reducing the massive effects wildfire can have on air quality.

There are several methods by which emissions associated with prescribed burning can be limited so as not to exceed ambient air quality standards. The majority of such measures involve limiting the level of fuel consumed. Measures that can be implemented include: (1) removal of fuel within the prescribed burn area, (2) limiting the size of the prescribed burn area, (3) seasonal timing of prescribed burn, (4) meteorologically driven timing of prescribed burn, (5) increased frequency of burning, (6) condensed burning areas, and (7) active monitoring. Additionally, public service announcements would inform the local populations of potential air emissions associated with prescribed burning and allow people to make accommodations to limit potential secondary health effects (e.g., use of personal humidifiers, staying indoors, personal respiratory aids, and reduced activity).

Because this analysis has been conducted at a programmatic level, site-specific evaluation will be necessary when planning prescribed fires. These individual evaluations should contain a higher level of detail than is presented in this document. The Service prepares and implements a step-down Wildland Fire Management Plans consistent with Federal Wildland Fire Management Policy (USDA

and DOI 2009) and to achieve refuge resource objectives. Plans were last finalized for the Billy Frank Jr. Nisqually NWR in 2003. Under all alternatives, an update would be developed using guidance from the Service's Wildland Fire Management Handbook (USFWS 2015). This handbook defines the Service-wide goal of wildland fire management to achieve resource objectives through prevention of human-caused wildland fires, to minimize the negative impacts on resources from all wildland fires that occur, and to guide the use of prescribed fire as an integral part of the resources management in a manner that minimizes the risk to the lives of employees, visitors, neighbors, and their property. Articulation of wildland fire management goals and objectives would be integrated with management goals and objectives from the CCP and other sources, as appropriate.

6.3.2 Effects to the Physical Environment at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Effects to Hydrology and Water Quality

Under both alternatives, BMPs would be used to minimize the negative impacts of habitat management and public use actions. Habitat management activities with the potential to affect hydrology and/or water quality include the use of pesticides or herbicides and herbivore grazing, which may have negative impacts in the short term, depending upon the location and related wildlife. Only State and Federally approved herbicides, including wetland-related, may be used on the Unit. Staff that apply pesticides are required to retain a public applicator license. See Section 6.3.1 for more information on effects of IPM and Appendix G for more information on the IPM methods. The long-term effect is expected to be minor.

Under both alternatives, grazing is included as an available tool for managing vegetation (Obj. 1.6, 1.7, 2.1). A potential negative impact from grazing activity on the Unit is a decline in water quality, as measured by turbidity and fecal coliforms from manure. The potential decline in water quality can be partially mitigated by reducing pathways for manure to enter waterways, accomplished through maintenance of electric and wire fences preventing cattle access to waterways, and by managing timing and location of grazing to avoid cattle presence while areas are flooded or have standing water.

Under both alternatives, the removal or replacement of fish passage barriers on new acquisitions would improve overall connectivity, including improvements to water flow and velocity. This would result in a minor to moderate, beneficial effect to hydrology.

Under Alternative 2, the Service would complete a detailed Water Resources Inventory and Assessment (WRIA) that would assist staff by identifying various management options to improve habitat conditions, water quality, and hydrologic regimes in the river system. The Service would coordinate and partner with appropriate agencies to sustain and enhance hydrological conditions needed to support channel habitat and ensure an appropriate water budget and delivery, including water quantity and quality.

Standard enhancement techniques (riparian plantings, IPM, placement of large woody debris, etc.) would be used, as appropriate, to improve tributary channel and riparian habitat conditions. There may be minor, short-term, negative effects of these enhancement techniques including disturbance to the waterways, local erosion, and sediment inputs. Riparian plantings and the placement of large woody debris would result in the following positive effects to hydrology:

- Increasing the stability of the stream channel by absorbing the energy of flood flows, reducing water velocity at low and moderate flows, protecting developing thickets of riparian vegetation, and reducing erosion of the stream bank and stream bed
- Affecting channel form and morphology by slowing and directing flood flows and temporarily storing sediment
- Promoting diverse hydrological and physical structure, including pools, hydraulic complexity, and roughness.

To address reed canarygrass in seasonally flooded, nonnative grassland habitat (Obj. 1.7), seasonally ponded areas would be evaluated and enhanced with improved water management capabilities as needed, through installation of water control structures, ditches, or culvert removal. Implementation of water control methods would negatively affect natural hydrology in the short and long term; however it may be necessary for invasive species control.

Construction of observation platforms and associated parking lots would not impact surface water quality as these facilities are not scheduled to be built over the river or tributaries. The enhanced boat launch and the small parking lot in the nearby upland would reduce sediments entering the river channel.

Overall Effects

Under Alternative 1, the overall effect to hydrology and water quality would be negligible to minor, negative in the short term and negligible to minor, positive in the long term. Under Alternative 2, the overall effect would be short-term, negligible to minor, and negative, and long-term, minor, positive impacts.

Effects to Topography, Geology, and Soils

Under both alternatives, habitat management actions may involve heavy equipment such as tractors or track vehicles to mow, hay, and disk, or otherwise manipulate the vegetation, especially to reduce the negative impacts of nonnative and invasive reed canarygrass. The use of heavy equipment could cause soil compaction. Repeated mowing, haying, or disking over an extended period of time regularly compacts soils, reduces natural soil porosity, and leads to less percolation and more runoff. However, negative impacts to the soils and geology of the area are anticipated to be localized and minor. Best management practices (e.g., not mowing over wet soils) would be followed to minimize impacts.

Herbivore grazing is included within the suite of IPM techniques under both alternatives (Obj. 1.6, 1.7, 2.1). The physical and structural impacts of grazing include removing healthy standing vegetation, trampling of other vegetation, and reducing populations of pioneering woody plants. If areas are grazed too early in spring when they are saturated or flooded, herbivores can break through the sod. This damages the underlying structure and creates an extremely uneven surface. This potential negative impact could be reduced by restricting grazing to the less wet seasons. Compaction can result from both grazing and the use of heavy equipment, causing undesirable increases in bulk density.

Under Alternative 2, the placement of large woody debris into tributary channel habitat may locally displace some soil and lead to bank erosion, although this effect is expected to be minor, short-term,

and local. Over the long term, moderate, positive effects are expected as stream bank stability increases and riparian vegetation grows in the stabilized, stored sediment. Soil productivity is expected to increase in the affected areas.

Forest management practices in the mixed forest habitat are expected to improve soil quality in the long term as more stable, native ground cover becomes established and organic matter increases. However these actions may also have short-term, adverse impacts such as erosion, compaction, and some loss of soil organic matter.

Under Alternative 2, the construction of new public use facilities would result in soil disturbance. During the construction of these facilities, soils would be disturbed to form graded surfaces and adequate foundations for the proposed paved areas and observation platforms. However, equipment and material staging areas would be identified to minimize soil disturbance and compaction onsite. Erosion control measures would be incorporated into site development plans to reduce or eliminate loss of site soils during construction. Since the collective footprint of these facilities would be relatively small, the overall anticipated adverse impacts to soil would be minor.

Overall Effects

Under both alternatives, the use of heavy equipment and grazing animals may produce temporarily impacted soils. Under Alternative 2, negative effects due to habitat management activity and construction projects would be minimized through use of BMPs. Minor, short-term, negative effects to the soils may occur, but an overall moderate, beneficial effect is expected over the long term.

Effects to Air Quality

The activities proposed may result in a slight and temporary increase in vehicle emissions due to the proposed use of heavy equipment in enhancing habitats for wildlife resources. Additionally, a slight increase in vehicular emissions could be expected due to an increase in visitation with the proposed viewing platforms, interpretive information, and parking areas.

Overall Effects

Overall, long-term effects to air quality should be negligible under all alternatives. Both alternatives would not be expected to have significant long-term effects to air quality compared to current management. Some minor, short-term impacts to local air quality may result from Unit management actions.

General Pollution Control

The Service has policies regarding pollution control at all of its facilities, including national wildlife refuges. These policies direct all Service employees to (1) comply with all applicable environmental laws and regulations, (2) reduce pollution, (3) inventory and properly treat or handle any hazardous substances; and (4) clean up or remove hazardous materials on contaminated sites. These policies are discussed in the Service's Manual in the 500 Series, which can be accessed at http://www.fws.gov/policy/manuals/. The Unit would comply with these policies under all alternatives.

With the proposed actions of Alternative 2, the overall water quality, water chemistry, temperature, and risk of contaminant release would remain unchanged. Some localized, short-term effects might occur associated with various land management activities, although they would be offset by implementing BMPs and would be temporary and localized.

Overall Effects

Some minor, short term, negative impacts may occur in habitat enhancement but may be offset by the positive wildlife response. Long-term soils, air quality, and water quality would remain the same as in Alternative 1.

6.3.3 Effects Common to All Habitats and Wildlife at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Under Alternative 1, no public uses would occur on the Unit, although public uses would continue to occur within the adjacent river channel. Under Alternative 2, the Unit would be opened to compatible wildlife-dependent public uses, including wildlife observation, interpretation, and wildlife photography. Disturbance impacts to specific habitat types as a result of public use programs are discussed in the following sections.

Under Alternative 1, inventory, monitoring, research, and scientific assessments regarding natural and cultural resources, public uses, and interactions among these elements would continue as at present. Relative to habitats, plant communities, and wildlife, most of these activities would involve observation and measurement. Occasionally, tissues or whole specimens of native or nonnative plants would be taken, removed, transplanted, or outplanted. In rare situations, tissues or whole specimens of native or nonnative animals would be purposefully or accidentally taken. Additionally, some of these activities would involve implementing and assessing various habitat management techniques, at small scales. Disturbance, including trampling and potentially transporting nonnative species, would be the primary effect of the vast majority of these activities. The effects of some of these activities, such as inventories of invasive plants or evaluations of the contributions of specific habitat management practices to achievement of goals and objectives, would be primarily local.

Overall, these activities would generate information which would be analyzed and interpreted to help staff assess the efficacy of management practices and facilitate appropriate course corrections as part of the adaptive management process. The effects of these activities on habitats, plant communities, and wildlife would be negligible to minor and positive. Compatibility determinations included in Appendix B address the effects and conditions associated with these uses in greater detail.

Under Alternative 2, inventory, monitoring, research, and scientific assessments regarding natural and cultural resources, public uses, and interactions among these elements would increase compared to those occurring at present. In addition to generating the same types of effects described for Alternative 1, it would be expected that this would result in an increase in information about the habitats, plant communities, and wildlife within the Unit. This would reduce uncertainty associated with wildlife and plant responses to habitat management, promote achievement of management goals and objectives, and facilitate adaptive management. For example, this would include better information about the efficacy of pest management programs.

Through application of adaptive management principles, enhanced knowledge would slowly lead to improved management and an increase in the health, productivity, and value of the Unit's wildlife habitats and plant communities to native vegetation and wildlife and an increase in the abundance and diversity of native wildlife within the Unit. The effects of these activities on the Unit's habitats, plant communities, and wildlife would have beneficial, minor to moderate effects. Compatibility determinations included in Appendix B address the effects and conditions associated with these uses in greater detail.

6.3.4 Effects to River and Tributary Channels and Associated Species at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Effects of Habitat Management Actions

There are approximately 7.5 miles of river within the current acquisition boundary and 16 miles of tributaries passing through or along the Unit boundary. Under both alternatives, the Service would work with WDNR to develop an interagency agreement or similar instrument that promotes cooperative management of the river channel between WDNR and the Service within the acquisition boundary. Cooperative management would help both the Service and WDNR protect fish and wildlife that use the river channel, allow the enforcement of Unit laws and regulations on the river channel, and define public access restrictions and management needed to provide improved wildlife protection from disturbance. The Service would also continue to maintain tributary channel habitat features that benefit a diversity of species (federally listed Oregon spotted frog, State endemic Olympic mudminnow, native fish, salmonids, and invertebrates). Efforts would be directed towards target invasive species (e.g., purple loosestrife) along the river and tributaries. These actions would result in short- and long-term, minor to moderate, beneficial effects.

The proposed removal of fish barriers on newly acquired lands with tributaries under both alternatives would benefit salmonids and other fish and wildlife that use channel habitats. Minor short-term, negative effects (e.g., soil disruption, increase in suspended sediment during removal, trampling of river bank from foot traffic, potential use of heavy equipment) would take place during the actual removal; however, these effects would be mitigated by scheduling the work at an appropriate time to minimize or eliminate impacts and employing best management practices.

Many of the issues associated with hydrological conditions in the river and tributaries are due to influences beyond the reach of the Unit alone. Alternative 1 does not include a WRIA. In Alternative 2, the Unit would pursue the completion of a WRIA to help identify hydrologic needs and proposes partnerships with appropriate agencies to sustain and enhance hydrological conditions needed to support the Black River and associated tributaries and ensure an appropriate water budget and water delivery takes place. Effects of this effort are expected to result in short- and long-term benefits for wetland habitats, fish, and wildlife associated with the Unit.

Under Alternative 2, the Service would actively seek new partnerships and strengthen existing partnerships to control priority invasive species and to stay abreast of newly developing problematic species. In both alternatives, the Unit would continue to work with Thurston County Noxious Weed Control Agency, WDFW, WDNR, and the Service's Washington Field Office (WFO) to assure the highest priority species threatening the river and tributary channel habitats are addressed.

Ideally, river and tributary channel habitat should have less than 15 percent cover of nonnative plant species (excluding reed canarygrass). To achieve this characteristic under Alternative 2, approximately 0.25 river miles of reed canarygrass would be treated each year. The Unit would also evaluate methods to control nonnative vertebrate species such as bullfrogs and nonnative fish that use channel habitats (see Appendix G). Control of these species would provide short- and long-term benefits to Oregon spotted frogs and mudminnows that occur in the same habitat. The Unit would partner with other agencies to determine the best course of action regarding nonnative fish.

In Alternative 2, more time and effort would be directed to controlling nonnative plant species that threaten the channels themselves and negatively impact the species that use them. As described in detail throughout Chapter 4, reed canarygrass is a major threat that has changed the ecology of the channels by reducing channel size from edge growth and rooting in the channel on submerged vegetation; growing over the water surface and thus reducing light penetration; impeding water flow and most likely wildlife and fish movement; restricting human movement through the channel; giving more surface area for algae attachment and coverage during annual summer algal blooms; and other effects not yet understood. Mapping of reed canarygrass infestation sites is needed to document and track areas in need of control. Reducing reed canarygrass impacts in this habitat type is very challenging, and cooperation, coordination, and assistance from partners familiar with this problem would be sought to determine the best control methods to deter growth and reduce reinfestation of channels and channel edges. Surveys for submerged nonnative plants would determine if other control efforts are needed. Other priority nonnative plant species that cause habitat degradation and need control with herbicide spot treatments include purple loosestrife and yellow flag iris. Other nonnative new species such as knotweed would need treatment as it invades from nearby uncontrolled sites.

The field work associated with invasive plant control can temporarily cause wildlife to move away and result in negligible habitat disturbances. Channel species dependent upon native habitats for foraging, cover, and loafing benefit from invasive plant control. The Black River is known for its low oxygen levels, primarily due to the extremely slow current (9-inch drop per mile), lack of ripples to break the surface, high organic content of the channel bottom and sides, and high nutrient loads. The lowest levels are in late summer and early fall. To avoid exacerbating the low dissolved oxygen condition, care would be taken during invasive plant control to minimize decomposition of biomass. This would cause less impact to native fish and invertebrates. If herbicides are used, a conservative approach is expected to produce minor to moderate, short-term, negative effects from chemical exposure with minor, long-term, negative effects depending upon the area of each treatment. The negative effects may be minor or moderate depending upon how much treatment is applied over time, but reclaiming the river and channel habitats from the threat posed by the nonnative, aggressive invasive plants would have an overall beneficial effect on all aspects of river and channel habitat, and the dependent fish and wildlife. The Unit would control nonnative bullfrogs, as needed, after presence/absence surveys are conducted in key locations (see Chapter 2 and Appendix G). Control of invasive species (reed canarygrass, warm-water fish, and bullfrog) provides both short- and long-term benefits to native animals, especially the Oregon spotted frog population. The Unit would partner with other agencies to determine the most effective, lowest impact method to control nonnative fish.

The effects of the above actions are expected to benefit an array of species including amphibians such as the Oregon spotted frog, red-legged frog, Pacific treefrog, rough-skinned newt, northwest and long-toed salamanders; waterbirds such as pied-billed grebe, belted kingfisher, great blue and green herons; fish such as Olympic mudminnow, three spine stickleback, prickly sculpin, cutthroat and

steelhead trout, chinook and coho salmon; benthic and aquatic invertebrates including freshwater mussels; insects such as Pacific clubtail dragonfly; freshwater sponge species; and mammals such as bat species, mink, muskrat, otter, beaver, and black bear.

Effects of Visitor Services Actions

The existing gravel right-of-way and boat ramp alongside the 123rd Avenue bridge provides access into Black River. Under Alternative 2, the Service would explore a partnership with Thurston County to facilitate improvements to this access. If not improved (Alternative 1), bank erosion from vehicles and trailers would continue to deposit sediment into the river channel (continue negative impacts). The improved boat ramp and parking area (Alternative 2) would be expected to result in moderate, short-term impacts during construction but long-term benefits by reducing the amount of bank erosion and sediment into the channel.

The boat ramp at this location would be a beneficial site to provide information about the Service and the Refuge System, as well as specific Unit rules and regulations which would minimize human footprints and disturbance to wildlife. The improved boat ramp and parking area would create the potential for additional visitors on and near the river channel habitat which could result in some minor additional disturbance to river-associated species and an increase in litter, especially fishing line. Abandoned fishing lines are known to entrap wildlife such as birds and may also entrap aquatic animals. The potential for greater disturbance and litter is a minor, negative effect over time.

With greater public use of the river, greater appreciation of the habitat and Unit would be expected, as well as an increase in conservation awareness.

Overall Effects

Under both alternatives, there would be positive effects from working with WDNR on cooperative management of the river channel and the removal of fish barriers, which would reconnect wetland habitats. Otherwise, Alternative 1 maintains existing resources that result in minimal effort directed toward active management of the river channel and larger landscape restoration and continued bank erosion from vehicles adjacent to the 123rd Avenue bridge. Overall, this is expected to have negligible to minor, negative effects. The overall effects of Alternative 2 would provide minor to moderate, beneficial effects. In particular, a greater effort to control nonnative, invasive plants and animals would reduce potential noxious seed sources and reduce weeds spreading to nearby wetland habitats in water flow through channels.

6.3.5 Effects to Bog Habitats and Associated Species at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Effects of Habitat Management Actions

Only a partial assessment of the bog habitat characteristics within the Unit boundary has been achieved and this would remain under Alternative 1. In Alternative 2, more time and effort would be directed towards controlling nonnative plant species that threaten or compromise habitats, including bog areas, and negatively impact the wildlife species inhabitants. Although little of the bog habitat has been explored, the initial impression is that nonnative and invasive plants do not appear to be a large problem. However, the sensitivity of this particular habitat would require a conservative

approach to controlling nonnative plants that would result in negligible or minor, short-term effects (hand cutting vs. chemical treatments).

In Alternative 2, consideration would be given to possibly translocating or introducing rare species into the bog area. Habitat function and resident species would be evaluated and expertise would be consulted to provide specific habitat management actions and minimize negative impacts. Only species missing from this south Puget Sound lowland bog habitat would be considered and would be investigated to determine how their presence could change the balance of the ecosystem. Specific protocols would be established including rigorous monitoring and decision tree.

Under Alternative 2, the designation of a Research Natural Area (RNA) would be evaluated, if warranted. If proposed and approved, the designation would provide greater conservation protection and awareness for this habitat. The short- and long-term effects of RNA designation would provide minor to moderate benefits to bog habitat by giving the area greater protection from human disturbance. The information gained would provide a baseline to which future changes can be compared (e.g., hydrology, water quality, species richness).

In total, these habitat management actions are expected to benefit species that are reliant on the bog complex, such as the rare Beller's ground beetle, Hatch's click beetle, and Queen Charlotte's copper butterfly. In addition, other species associated with bogs would benefit from an intact bog, including western bog laurel, bog cranberry, sundew, bog orchids, cotton grass, and if present, the federally listed water howellia.

Effects of Visitor Services Actions

Bog habitat within the Unit would remain closed to visitors under both alternatives due to the sensitivity of this unique area.

Overall Effects

In summary, the effects under Alternative 1 would remain negligible with no work or access to this habitat. The proposed actions of Alternative 2 are expected to have negligible to minor, short-term, negative effects primarily because they entail initial access into the unique bog habitat for inventory and habitat assessments. In the long term, the inventory and habitat assessments would be expected to provide moderate, beneficial, indirect effects to both the bog habitat and associated species.

6.3.6 Effects to Shrub Swamp and Associated Species at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Effects of Habitat Management Actions

Little of the 512 acres of shrub swamp habitat has been assessed and the amount of nonnative plants and animals is unknown. Access is very difficult and conducting a baseline survey on portions away from the edge of river channel habitat would be among the first steps addressing action on priority nonnative weed species. The shrub swamp habitat that joins the river channel habitat shows significant reed canarygrass infestation. Additionally, a small amount of purple loosestrife and a moderate amount of yellow flag iris infest the edge of the shrub swamp near the river channel.

Under Alternative 1, control of reed canarygrass would be minimal in this habitat where the vegetation density is difficult to access and maintain. The level of effort would continue to be directed at specific invasive plants (i.e., yellow flag iris, purple loosestrife) to prevent spread and new establishments resulting in minor, short-term, negative impacts as wildlife disturbance may occur during treatments. In Alternative 2, more acreage (minimum of 5 percent or 25.6 acres) and effort would be put into controlling nonnative plant species that threaten or compromise Unit habitats and negatively impact the species that use them. A greater effort to survey the habitat is expected to have negligible to minor short-term negative effects. Reclaiming the transition between river channel and shrub swamp habitats from the threats posed by reed canarygrass would have a moderate beneficial effect on all aspects of channel habitat and the fish and wildlife that depend in its resources.

Positive effects of the invasive plant control actions promoted by Alternative 2 would enhance habitats to a greater degree than Alternative 1. They are expected to diversify vegetation composition and resources and benefit an array of wildlife species, including amphibians such as Oregon spotted frog, red-legged frog, Pacific tree frog, rough-skinned newt, northwest and long-toed salamanders; waterbirds such as pied-billed grebe, belted kingfisher, great blue and green herons; migratory and resident passerines such as willow and Pacific slope flycatchers, downy woodpecker, marsh wren, flycatcher species, warblers such as McGillivray's, Wilson's, orange-crowned, yellow-rumped, and common yellowthroat; song sparrow; some fish such as Olympic mudminnow, three spine stickleback, prickly sculpin, and, perhaps during high water periods, cutthroat and steelhead trout, chinook and coho salmon would benefit; benthic and aquatic invertebrates, including freshwater mussels, insects such as Pacific clubtail dragonfly, and freshwater sponge species; terrestrial pollination insects; and mammals such as bat species, mink, muskrat, otter, beaver, and black bear.

Effects of Visitor Services Actions

Unit lands such as the shrub swamp adjacent to the river channel are not open to the public, and would remain closed under both alternatives. No negative or positive effects to the habitat from public use or visitor services actions should be incurred.

Overall Effects

In summary, Alternative 1 would have negligible overall effects because of limited staffing and access into the areas. The overall effect of the proposed habitat actions in Alternative 2 is minor to moderately beneficial to the habitat, long-term, especially for invasive plant control near the interface with the river channel.

6.3.7 Effects to Riparian Habitat and Associated Species at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Effects of Habitat Management Actions

Approximately 265 acres of riparian habitat is mapped, however, little of it has been visited to gain baseline biological information. Under Alternative 1, this is not expected to change due to limited resources (i.e., staffing); however, under Alternative 2, a concerted effort would be made to identify the biological and ecological integrity along the Black River and its tributaries.

Enhancing the riparian habitat structure and function can be accomplished by controlling priority invasive plants (e.g., purple loosestrife) and preventing them from dispersing and becoming established in other areas. Alternative 1 would maintain the few current areas whereas Alternative 2 would include additional areas to control invasive species and enhance habitat by planting native trees and shrubs. Habitat strategies (Chapter 2) suggest a minimum of 20 percent (53 acres) of riparian habitat be annually managed to control priority problem plants. Following established forestry practices would augment riparian habitat structure and function and to increase plant diversity (Carey 2003, 2006).

Control of priority nonnative plants is expected to produce minor, short-term, negative effects primarily due to potential wildlife disturbance. There are a limited number of herbicides that are approved within riparian corridors for water quality concerns; therefore, negative impacts are expected to be minor and short-term. The long-term benefits of species native to the habitat would be minor to moderate as a diverse habitat would also benefit wildlife, including some amphibians such as the rough-skinned newt, northwest and long-toed salamanders, and Pacific tree frog; green heron, migratory and resident passerines such as McGillivray's, Wilson's, orange-crowned, black-throated gray, and yellow-rumped warblers, warbling vireo, willow and Pacific slope flycatchers, rufous hummingbird, American robin, spotted towhee, purple finch, song and fox sparrows, black-headed grosbeak, Bewick's and winter wrens, cedar waxwing, red-breasted sapsucker and downy woodpecker; raptors such as sharp-shinned and Cooper's hawks; and tree–cavity-nesting waterfowl such as wood duck and hooded merganser; terrestrial pollination insects; and mammals such as bat species, mink, muskrat, otter, coyote, black bear, bobcat, and cougar. This list is not exhaustive and could include other species. Benefits should have short- and long-term effects.

Effects of Public Use Actions

Under both alternatives, the Unit's riparian forest is not open to the public. Neither negative nor positive effects to the habitat from public use or visitor services actions should be incurred.

Overall Effects

In summary, the overall effect of the proposed habitat actions in Alternative 2 would be minor to moderately beneficial to the habitat because a greater effort to control invasive plants would be made. Alternative 1 would have negligible overall effects because of limited staff and funding to complete management and biological projects.

6.3.8 Effects to Emergent Marsh Habitat and Associated Species at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Effects of Habitat Management Actions

Over 34 acres of emergent marsh occur on the Unit. The marsh is important to the federally threatened and State-listed Oregon spotted frog for breeding, egg laying, and developing tadpoles. However, emergent marsh habitat is perhaps the most vulnerable and degraded of all wetland habitats on the Unit due to the establishment of invasive reed canarygrass. Reed canarygrass tends to form dense monocultures and displace native herbaceous plants and grasses. Because shallow areas retain water into the late summer and are composed of unstable soils, it is difficult to control reed canarygrass in any of the emergent marsh locations and create optimal or even acceptable habitat

conditions for Oregon spotted frog breeding and egg laying. Under Alternative 1, the Unit would continue to conduct limited invasive plant management, scheduled to minimize impacts to wildlife, and would be expected to result in negligible impacts.

In Alternative 2, a minimum of 20 percent of emergent marsh habitat would be managed annually to control nonnative plant species and enhance habitat, especially for Oregon spotted frog. A variety of IPM techniques would be used to manage the vegetation, particularly to control reed canarygrass. These techniques have potential impacts to other plant species and wildlife. For example, mechanical methods such as mowing can cause direct mortality to various birds, small mammals, reptiles, and amphibians. Not only are these species subject to mortality from machinery, but the dense vegetation cover is converted to sparse vegetation and pockets of short vegetation until wetland plants reestablish. The use of equipment can cause soil compaction or soils/water contamination. To minimize these impacts, mowing would be performed only when soils are dry enough to support equipment. The impacts of management could be reduced by delaying operations until after most wetland bird species have completed nesting.

To minimize the risk of contamination, equipment would be regularly maintained and inspected before each use. Spill kits would be available onsite and all maintenance would be sited away from wetlands and waterbodies. Equipment operators would be trained in spill prevention and response and they would be provided appropriate personal protective equipment.

The impacts of IPM methods are expected to be minor and negative in the short term. In the long term, if maintained, the condition of emergent marsh habitat on the Unit would improve, leading to minor, positive, long-term effects.

Under both alternatives, Unit staff would share information and collaborate with other agencies and partners to determine the most effective control methods, or alternative methods to reduce the negative effect of this grass on Oregon spotted frog and other wildlife species (e.g., migratory and resident birds).

Under both alternatives and within policies and guidelines for the threatened Oregon spotted frog, egg masses may need to be moved as seasonal water recedes. This activity would allow the eggs to develop into tadpoles and would be expected to have negligible, negative effects in the short term, which are outweighed by moderate, positive effects in the long term through recruitment into the population.

Habitat management activities are expected to promote a more diverse assemblage of plant species, and a mosaic of water and vegetation that provides foraging opportunities and cover for a diversity of wildlife species, including amphibians such as Oregon spotted frog, red-legged frog, Pacific tree frog, rough-skinned newt, northwest and long-toed salamanders; shorebirds such as green heron and Wilson's snipe; migratory and resident waterfowl such as mallard, American wigeon, northern shoveler, northern pintail, American green-winged, blue-winged, and cinnamon teal; coot, Canada and cackling geese; migratory and resident passerines such as purple martin, tree-, violet-green, and rough-winged swallow, northern harrier, red-winged blackbird; migrating shorebirds including greater yellowlegs; raptors such as northern harrier; mammals including mouse, shrew, vole, mole, bat species, coyote, black-tailed deer, elk, black bear, bobcat, and perhaps cougar; garter snake species; and freshwater and terrestrial invertebrates. This list is not exhaustive, and could include other species. Benefits should have short and long-term effects.

Effects of Visitor Use Actions

Under Alternative 1, the emergent marsh lands would remain closed to the public. However, a strategically located viewing platform under Alternative 2 would provide observation and educational (interpretive panels) opportunities. Negative effects to the emergent marsh habitat from visitors are not expected.

Overall Effects

In summary, the overall effect of Alternative 1 is negligible as current conditions would persist. The overall effects of habitat actions under Alternative 2 are expected to be minor, short-term, and negative; however, the long-term effects would benefit the integrity of the emergent marsh habitat and the diversity of species using the areas, especially Oregon spotted frog. Additional moderate long-term benefits include public environmental education through observation and interpretation.

6.3.9 Effects to Seasonally Flooded, Nonnative Grassland and Associated Species at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Effects of Habitat Management Actions

Over 82 acres of seasonally flooded, nonnative grassland habitat is composed of 95–100 percent reed canarygrass. This tall, densely growing grass successfully outcompetes or crowds out virtually all other native herbaceous plants (see Chapters 2 and 4). The Unit's objective would be to manage these areas as short-grass or no-grass to promote use by Oregon spotted frog. Attempts to restore wetland habitats with such a high percentage of reed canarygrass have mixed success in the Pacific Northwest without a major investment in water management capabilities such as dikes, water level control structures, water pumps, and methods to mechanically or chemically disturb the grass.

Currently, small patches of lowland depressions dry out enough to be mowed or hayed, resulting in a more open area that then becomes flooded with fall, winter, and spring seasonal rains. With late-fall mowing, waterfowl and small wetland obligate mammals use the sites in winter, and because grass grows slowly that time of year, the sites can become adequate Oregon spotted frog egg-laying habitat in early spring. This habitat can also provide temporary foraging sites for greater yellowlegs, killdeer, Wilson's snipe, and Canada and cackling geese. A small pilot project was tried to determine herbivore impacts on reed canarygrass and whether herbivores could be used as a tool to reduce grass biomass and to enhance frog egg-laying conditions. Initial indications are that it may be an effective tool. Another site is now being similarly managed. Other sites are managed with combinations of techniques. These management options and others have the potential to improve wildlife habitat quality given the compromised conditions.

Both alternatives promote cooperation, coordination, and creative partnerships to identify effective methods to create a short-grass or no-grass condition for spring Oregon spotted frog egg-laying season and shallow water areas from late winter to fall, if possible. Under Alternative 2, up to 25 acres would be actively managed (as opposed to the current 0.75 acres). Additionally, seasonally ponded areas would be evaluated and enhanced and water management capabilities would be improved as needed, through installation of water control structures, ditches, or culvert removal. The potential negative impacts to wildlife as a result of habitat management activities are expected to be

short-term and minor as a result of scheduling activities when frogs are least active (seasonal) and employing different methods of treatment (mowing vs. hand cutting) based on habitat conditions (moist soil vs. dry ground) to minimize impacts. In accordance with Service policies, species-specific management strategies would be thoroughly documented in the Service's biological opinion and section 7 consultation prior to performing activities.

In some situations, Oregon spotted frog egg masses can be stranded or suffer desiccation from loss of surface water as water recedes. Moving egg masses short distances into more appropriate water levels is occasionally the only option for tadpole development and survivorship. In both alternatives, moving eggs a short distance to sites with adequate water conditions would be beneficial in allowing normal development from egg to tadpole stage. Given the limited amount of quality breeding sites and the variability in weather conditions affecting surface water levels, this activity is expected to result in moderately beneficial to the frog population.

The effects of management activities in seasonally flooded, nonnative grasslands is expected to also benefit other wildlife (salamanders, migratory and resident waterfowl species, passerines, and mammals) to varying degrees depending on the water and vegetation conditions.

Effects of Visitor Services Actions

Seasonally flooded, nonnative grassland habitat areas would not be open to the public under Alternative 1; therefore, the effects are expected to be negligible. Alternative 2 includes a short trail and viewing deck on higher ground for wildlife observation in one area east of Endicott Road. Construction of the deck is expected to incur minor, short-term, negative effects, but these would be mitigated by scheduling the work when wildlife use is lowest. Consideration would be made to locate the deck in an area that would result in minimal, if any, long-term impact to wildlife and with appropriate structures to keep visitors on designated paths.

Overall Effects

In summary, under both alternatives, the overall negative effects are expected to be minor to moderate in the short term. Under Alternative 2, long-term, moderate, beneficial effects for wildlife outweigh the negative effects. Effects are moderately beneficial for Oregon spotted frog and those wetland species that rely on wetlands not dominated by reed canarygrass. The viewing platform and associated interpretive panels are expected to have beneficial, long-term effects in promoting the conservation of grassland and wetland habitats and their inhabitants.

6.3.10 Effects to Dry, Nonnative Grassland Habitat and Associated Species at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Effects of Habitat Management Actions

Control of priority nonnative species using IPM methods discussed in Appendix G would occur under both alternatives. As described above, the nonnative grasses would be managed for short-grass conditions. Reed canarygrass does not thrive in well-drained upland soils, so it is not a management concern; however, wild chervil is a concern. Minor, short-term effects may occur, but beneficial, short-term effects would also occur. Beneficial, minor to moderate, long-term effects would occur depending upon which species use the habitat.

Under Alternative 2, management would perpetuate early seral stage, upland, short-grass areas that support wildlife associated with the habitat type. Under Alternative 1, the dry, nonnative grasslands (or former pastures) are hayed. Under Alternative 2, the areas would continue to be managed similarly but approximately 15 acres would be enhanced to achieve greater composition of native grasses and forbs (native herbaceous flowering plants) by using a variety of techniques that may include mowing, haying, herbivore grazing, planting, seeding, prescribed burning, or regular maintenance work. Management techniques would not be used from spring to mid-summer or until passerine nesting season is completed, as many bird species nest upon the ground in this habitat type. Adjacent prairies support species that rely predominantly on that habitat type. Some of the generalist species may use both the prairie and upland short grass habitats. Grasslands on the Unit consist primarily of nonnative grasses as a result of previous land use practices (agriculture, grazing) and are not considered native prairies with specific soils. For this reason, full-scale dry prairie restoration is not considered under either Alternative 1 or 2.

Some wildlife species benefiting from this management could include American kestrel, savannah sparrow, western meadowlark, lazuli bunting, western bluebird, killdeer, common nighthawk, Canada and cackling goose, northern shrike, red-tailed hawk, western screech owl, barn owl, possibly short-eared owl; reptile species such as snake species and northern alligator lizard; pollination insects; and mammals such as bat species, mouse, vole, mole, weasel, spotted skunk, Roosevelt elk, black-tailed deer, coyote, black bear, bobcat, and possibly cougar. Those species associated with native prairies may also benefit as the sites are discovered by those specialists. Management techniques would not be used from spring to mid-summer or until passerine nesting season is completed, as many bird species nest upon the ground in this habitat type. The effect of management actions may displace wildlife temporarily but the impact would be short lived. Long-term effects would be moderately beneficial for wildlife dependent upon this habitat type.

Effects of Visitor Services Actions

A portion of the upland, nonnative grasslands would be open to visitor viewing off Endicott Road. On the west side of the road a vehicle pull-off area that would hold between 5 and 10 vehicles and 1 bus would be created, as would a viewing platform and interpretive signage. On the east side of Endicott Road another small parking lot (five vehicles) and a viewing platform with interpretive signs would be built. These structures would remove habitat from wildlife use, however, the loss would be less than 3 acres. The habitat loss is not irrevocable and is minor in both the short- and long-term. If visitors remain on the viewing platforms and do not enter the habitats, wildlife would remain undisturbed. The benefit of providing public viewing sites and interpretive panels would be to encourage visitors to learn about the Service, the National Wildlife Refuge System, Black River Unit, and habitats and the wildlife that use them.

Overall Effects

Under Alternative 1, negligible to minor, positive impacts would occur due to the limited management. Under Alternative 2, minor, negative, short-term impacts are expected; however, in the long term, the additional habitat enhancement would provide minor positive impacts. Public use actions would result in negligible to minor, negative impacts. In summary, the positive effects outweigh the potentially negative effects regarding habitat and associated wildlife.

6.3.11 Effects to Mixed Forest Habitat and Associated Species at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Effects of Habitat Management Actions

The Unit includes approximately 394 acres of upland mixed forest habitat. Management activities, including IPM techniques to control invasive or undesirable plant and animal species, would continue under Alternative 2 as they have under Alternative 1. In addition, approximately 20 percent of the habitat would be assessed annually for nonnative plant infestation, and control efforts would take place if necessary. Standard forestry management practices would be used to enhance former restoration plantings to create functional, young forests with a mid-story and understory (see Chapter 4 and Carey 2003, 2006). Existing forests would be evaluated and enhanced as needed. Minor, temporary, localized disturbance and damage from habitat management could occur as a result of using these actions, including displacement of wildlife, ground disturbance, and potential weed spread. However, it is expected that these effects would be temporary and localized and shortly eclipsed by enhanced stand structure and composition.

The effects of the above actions should benefit an array of species, including early to mid-successional associated species such as black-capped chickadee, yellow-rumped and orange-crowned warbler, white-crowned and song sparrow, rufous-sided towhee, dark-eyed junco, Steller's jay, crow species, butterfly and moth species, garter snake species, northern alligator lizard, western red-backed salamander, mouse, shrew, vole, bat species, weasel, opossum, raccoon, spotted skunk, coyote, bobcat, black bear, cougar, Roosevelt elk, black-tailed deer. In mid- to mature successional forests with well-developed understories, chestnut-backed chickadee, pileated woodpecker, varied thrush, band-tailed pigeon, bald eagle, Cooper's and sharp-shinned hawk, western screech owl, northern saw-whet, great horned owl, Vaux's swift, winter wren, Pacific-slope flycatcher, brown creeper, Townsend's warbler, hermit thrush, and Steller's jay, snake species, Townsend's chipmunk, Douglas squirrel, flying squirrel, spotted skunk, bat species, weasels, mouse, shrew, voles, opossum, coyote, bobcat, black bear, cougar, Roosevelt elk, black-tailed deer. Mature to old growth forests may support the federally listed northern spotted owl. This list is not exhaustive, and could include other species. Benefits should have short- and long-term effects.

Effects of Visitor Services Actions

Under both alternatives, mixed forest habitats would not be open to the public. No negative or positive effects to the habitat from public use actions should be incurred.

Overall Effects

Overall, a minor, positive, long-term effect would occur for mixed forest habitat and associated species under Alternative 2 because habitat management would create a higher quality of habitat that has fewer invasive species and a more diverse vegetation structure. Although there are some short-term, negative impacts that would occur from habitat management actions, they are considered minor relative to the overall benefit that would be realized in the long term through higher habitat quality. A negligible effect would occur under Alternative 1 since there is currently a limited active management program.

6.3.12 Effects to Threatened and Endangered Species at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Effects of Habitat Management Actions

Listed species receive special consideration in terms of Unit management. Federally listed species are trust resources that require additional consultation whenever an activity conducted by or permitted by the Unit may have an effect on these species or their habitats. Impacts to these species from wildlife-dependent recreation and habitat management are assessed in this chapter. Impacts associated with the use of herbicides and pesticides are assessed in the IPM plan in Appendix G.

The only federally listed species known to occur within the Black River Unit is Oregon spotted frog. Activities to enhance the habitats for the frog primarily target invasive species using an integrated approach that includes mowing, haying, disking, grazing, and application of Service-approved herbicide. Specialized guidelines and permits would be developed under both alternatives; however, the level of effort would vary from maintenance of habitat (Alternative 1) to an increased effort to not only maintain minimal habitat but also larger-scale habitat enhancement (Alternative 2). The Unit would work in partnership with the Service's WFO and WDFW to assure required evaluations, biological opinions, and assessments are completed and approved prior to habitat management activities. Overall, repeated habitat enhancements (Alternative 2) are expected to have great beneficial effect on the frog both in the short and long term, as has been shown in a few recent habitat modifications undertaken by the Service, WDFW, and private land owners.

Water howellia status on the Unit is unknown. In Alternative 2, inventories to determine presence or absence would be undertaken (Chapter 2, Goals 1 and 4; Chapter 4). If it is discovered, habitat enhancement efforts would be started. Until found and assessed, no effects can be determined; however, if habitat modifications are needed to enhance the plant's survivorship, the actions would be moderately beneficial for the short- and long-term existence of the population.

Effects of Visitor Services Actions

No effects from public use are expected to Oregon spotted frog or water howellia if present on the Unit, assuming the public respects the regulations and access restrictions planned in Alternative 2.

Overall Effects

In the case of Oregon spotted frog, repeated habitat enhancements may cause the loss of a few individual frogs, but would also have great beneficial short- and long-term effects on the frog's habitat. As has been shown in a few recent habitat modifications undertaken by the Service, WDFW, and private land owners, Oregon spotted frog can respond by rapidly increasing numbers and sustain those numbers for a while, even as the habitat may again degrade with re-encroaching invasive plants.

6.3.13 Effects to Social Environment at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Effects of New Facilities

With the proposed construction of two visitor observation decks with interpretive panels, posted regulations, parking lots, an enhanced boat launch area, and current rising interest in the Unit, visitation is estimated to grow to nearly 4,000 visitors per year during the 15-year life of the CCP. This increased interpretive contact is expected to result in better understanding and support for the Unit and the Refuge System; more visitors from diverse backgrounds, particularly urban residents; increased environmental awareness of natural resources; better protection of natural resources; and more involvement by community members, volunteers, and partners. The planned new facilities would lead to a safer and more comfortable visitor experience. However, increased visitation may lead to more crowding at times such as weekends when visitation tends to be greatest. If visitors do not follow regulations and enter closed habitats, wildlife may be disturbed to a greater degree. This activity could lead to a slight, long-term, negative effect to the quality of individual visitor experience.

Effects of Visitor Services Actions

The Unit has been closed to the public during this acquisition stage; therefore, visitation numbers are not collected. The projected visitation for the future 15 years is nearly 4,000 visits per year.

Overall Effects

Under Alternative 2, the overall social effects would be beneficial because for the first time, the public would have visitor viewing areas and could learn more about the Black River Unit and National Wildlife Refuge System.

6.3.14 Effects to Opportunities for Quality Wildlife Observation and Photography at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Effects of Habitat Management Actions

Enhancing habitat through nonnative plant reduction, especially along the river and in marshes, would provide greater opportunity for visitors to observe wildlife and wildlife interactions. There may be some negative, short-term effects to the visitor experience as some enhancement work proceeds, but the public could observe habitat enhancement efforts.

Enhancing dry, grassland habitat would encourage observation of wildlife associated with that habitat. Enhancing emergent marsh and nonnative, seasonally flooded, grasslands would encourage greater use by appropriate wildlife species that are also popular for observation and photography. These beneficial management effects for wildlife also are greatly beneficial for the visitor experience.

Partnering with Thurston County to improve to the county boat launch at 123rd Avenue and create a small parking area on Service lands away from the river would benefit river water quality and nearby

habitats in both the short- and long term. In addition, the enhanced boat ramp and parking area would create the potential for additional visitors on and near the river channel habitat over the course of 15 years. Easier boat access, resulting in greater opportunities to observe wildlife, would be both a short- and long-term beneficial effect; however, the increased chance of litter would be a minor negative effect.

With greater public use of Refuge lands adjacent to the river, minor to moderate positive effects from greater appreciation of the habitat and Unit would be expected, as well as an increase in conservation awareness. Minor to moderate short- and long-term negative effects related to wildlife disturbance, and related threats from nonnative vegetation increased litter could occur but may be offset by posted regulations and interpretive panels.

Overall Effects

Overall the effects to opportunities for quality wildlife observation and photography from the described activities (above) would be minor to moderately beneficial for various groups of visitors in both the short and long term. The positive benefits outweigh the few negative aspects of litter and the risk of nonnative animal or plant introduction.

6.3.15 Effects to Cultural Resources at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

The Service is committed to protection of known cultural resources under both alternatives. Cultural resources can be of significant cultural, scientific, and educational importance. It is essential that the Service look beyond mere compliance with cultural resource laws to ensure protection of these nonrenewable resources. Of critical importance is the development of close working relationships with organizations that express affinity with the Unit's cultural resources such as Native Americans, historians, and educators.

There are no recorded prehistoric sites and four recorded historical sites within the Black River Unit boundaries. Other historic sites and features may exist on the Unit which have not been recorded. Several prehistoric and historic sites or features have been recorded within 1 mile of the Unit. Three of the historic sites within Unit boundaries have been evaluated and determined ineligible for the National Register of Historic Places (NRHP). One site has been evaluated and 9 of its 20 structures were determined to be contributing elements to the eligibility of the site to the NRHP. All of the contributing structures were documented to meet the stipulations of a Memorandum of Agreement between the Service and the SHPO in 2005 to mitigate for eventual demolition of all structures on the property that pose a safety risk to humans or wildlife (USFWS 2011).

Prior to implementing any ground-disturbing projects, the applicable cultural resource compliance investigation would be undertaken. If cultural resources are found, appropriate procedures and protocols would be followed to protect them. Whenever possible, resources would be avoided or mitigated. Mitigation options, in addition to site avoidance by relocating or redesigning facilities, would include data recovery, using either collection techniques or in-situ site stabilization protection.

Overall Effects

The short- and long-term effects of planned Unit actions that may impact cultural resources would follow Service and SHPO requirements and would be considered minor and beneficial under Alternative 2. Compliance with cultural resource investigation protocol prior to conducting ground-disturbing actions, and subsequent compliance with procedures if cultural resources are found, would ensure that negative impacts to cultural resources from implementation of any of the alternatives are negligible.

6.3.16 Effects to Economy at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

See section 6.2.10 for Grays Harbor NWR for a discussion on economic effects and how they are estimated.

Recreational Activities

Alternative 1 (Current Management): Recreational Activities

Under Alternative 1, the Black River Unit, including lands that adjoin the river, would continue to be closed to public use. There are no economic impacts generated by recreational visitation because the Unit is currently closed to the public. Activities that occur within the river channel are not under the Service's jurisdiction and thus are not taken into account in this analysis.

Alternatives 2: Recreational Activities

Under Alternative 2, the Unit would open to a variety of nonconsumptive uses. Visitors would enjoy access for boat launching, observation, photography, and interpretation opportunities. Table 6-14 shows the visitation that would occur if Alternative 2 is fully implemented. Approximately 3,910 visits would be related to a variety of recreational opportunities. All recreational visitors would participate in nonconsumptive activities.

Table 6-14. Alternatives 2: Projected Annual Unit Visitation

Activity	Residents	Nonresidents	Total
Nonconsumptive			
Pedestrian	2,628	657	3,285
Auto Tour	0	0	0
Boat Trail/Launch Visits	195	65	260
Bicycle Visits	0	0	0
Photography	292	73	365
Other Recreation	0	0	0
Interpretation	2,628	657	3,285
Hunting			
Waterfowl	0	0	0
Other Migratory Birds	0	0	0

Activity	Residents	Nonresidents	Total
Upland Game	0	0	0
Big Game	0	0	0
Fishing			
Freshwater	0	0	0
Saltwater	0	0	0
Total Visitation	3,115	795	3,910

Regional Economic Analysis

Visitor recreation expenditures associated with a fully implemented Alternative 2 are shown in Table 6-15. Total annual expenditures would be about $52,100 with nonresidents accounting for about $26,800 or 51 percent of total expenditures.

Table 6-15. Alternatives 2: Visitor Recreation Expenditures (2011 dollars in thousands)

Activity	Residents	Nonresidents	Total
Nonconsumptive	$26.80	$25.30	$52.10
Hunting	–	–	–
Fishing	–	–	–
Total Annual Expenditures	$26.80	$25.30	$52.10

Input-output models were used to determine the economic impact of expenditures on the Unit's local economy under Alternative 2. The estimated economic impacts are expected to occur in Thurston County. Table 6-16 summarizes the local economic effects associated with recreation visits. Under Alternative 2 economic output would total $79,400 with associated employment of one job, $24,600 in employment income and $11,100 in total tax revenue.

Table 6-16. Alternatives 2: Local Economic Effects Associated with Recreation Visits (2011 dollars in thousands)

	Residents	Nonresidents	Total
Economic Output	$40.80	$38.60	$79.40
Jobs	0.4	0.4	1
Job Income	$12.60	$12.00	$24.60
Tax Revenue	$5.70	$5.40	$11.10

Summary of Recreational Visitation Impacts

Table 6-17 provides a summary of the potential economic impacts related to recreational visitation for each alternative. Under Alternative 2, recreation visitation would increase after the management alternative is fully implemented. As a result, economic output, jobs, job income, and tax revenue would increase.

Table 6-17. Annual Economic Effects Associated with Recreation Visits (2011 dollars in thousands)

	Alternative 1	Alternative 2
Recreation Visits	–	3,910
Expenditures	–	$52.10
Economic Output	–	$79.40
Jobs	–	1
Job Income	–	$24.60
Tax Revenue	–	$11.10

Unit Budget

Annual costs reflect spending of base funds allocated each year. These are also known as recurring costs and are usually associated with day-to-day operations. Nonsalary expenditures are primarily fixed costs such as utilities, office supplies, vehicle gas and maintenance, habitat restoration and management, fencing and posting, and invasive plant monitoring and management.

Table 6-18 shows that average annual expenditures would be about $53,000 for Alternative 1 and approximately $527,000 for Alternative 2. The estimated expenditures for Alternative 2 assume that the alternative is fully funded as described in the CCP.

Costs estimated for Alternative 2 include a higher number of additional employees to help manage habitat and visitor services programs. Increased nonsalary expenditures would include habitat management and restoration, invasive plant monitoring and management, and visitor services facilities maintenance and operations, among other costs.

Table 6-18. Average Annual Expenditures (2011 dollars in thousands)

Expenditure	Alternative 1	Alternative 2
Salary	$32.30	$408.10
Non Salary	$20.60	$119.00
Total	$52.90	$527.20

Table 6-19 shows the economic impact of average annual (salary and nonsalary) expenditures. Impacts associated with annual expenditures would continue to occur throughout the timeline of the CCP if the alternative is fully funded. Under Alternative 1, the Unit's annual expenditures would generate approximately $78,700 in economic output, one job, $33,500 in job income, and $11,100 in tax revenue. Economic impacts for Alternative 2 would be higher due to a larger budget. Annual expenditures under Alternative 2 would generate approximately $763,900 in economic output, six jobs, $288,800 in job income, and $104,800 in tax revenue.

Table 6-19. Local Annual Economic Effects Associated with Average Annual Unit Budget (2011 dollars in thousands)

	Alternative 1	Alternative 2
Economic Output	$78.70	$763.90
Jobs	1	6

	Alternative 1	Alternative 2
Job Income	$33.50	$288.80
Tax Revenue	$11.10	$104.80

Table 6-20 shows the change in economic impacts associated with the Unit budget compared to the baseline (Alternative 1). Once fully funded, annual expenditures for Alternative 2 would increase by $474,200, respectively, compared to Alternative 1. Under Alternative 2, economic impacts associated with annual expenditures would increase by $685,200 in economic output, five jobs, and $255,300 in job income compared to Alternative 1.

Table 6-20. Change in Annual Expenditures Compared to the Baseline (Alternative 1) (2011 dollars in thousands)

	Alternative 2
Annual Expenditures	+$474.20
Economic Output	+$685.20
Jobs	+5
Job Income	+$255.30
Tax Revenue	+$93.70

Revenue Sharing Payments

Under provisions of the Refuge Revenue Sharing Act (Public Law 95-469), the Service would annually reimburse Thurston County for tax revenue which is lost as a result of the Service's acquisition of private property. This law states that the Secretary of the Interior (Secretary) shall pay to each county in which any area acquired in fee title is situated, the greater of the following amounts:

- An amount equal to the product of 75 cents multiplied by the total acreage of that portion of the fee area that is located within such county.
- An amount equal to three-fourths of one percent of the fair market value, as determined by the Secretary, for that portion of the fee area that is located within such county.
- An amount equal to 25 percent of the net receipts collected by the Secretary in connection with the operation and management of such fee area during such fiscal year. If a fee area is located in two or more counties, however, the amount for each county shall be apportioned in relationship to the acreage in that county.

The appraisal estimate value is based on the current local land values at the time of the appraisal. The Refuge Revenue Sharing Act payments to Thurston County for the Black River Unit and portions of the main unit of Billy Frank Jr. Nisqually NWR within the county have averaged $15,721 annually from Fiscal Years 2011 to 2013.

Forecasting revenue sharing payments is complex. Actual payments are a function of the appraised value and appropriations. The Refuge Revenue Sharing Act requires Service lands be reappraised every 5 years to ensure that payments to local governments remain equitable. However, some

payments are less than the legislated amounts due to governmental funding deficits. Congress may appropriate, through the budget process, supplemental funds to compensate local governments for any shortfall in revenue sharing payments. The final calculation for the payment to local governments depends on the total amount of funds available from revenue receipts collected on refuges nationwide and any appropriations. As a result, payments fluctuate based on the revenue receipts and appropriations. Due to the size of the revenue sharing payment, economic impacts would be negligible.

Overall Effects

This section summarizes the economic impacts generated by Unit management activities for each alternative. Table 6-21 summarizes the economic impacts in Thurston County for Alternative 1. Under Alternative 1, Unit activities would generate an estimated $78,700 in economic output, one job, $33,500 in job income, and $11,100 in state and local tax revenue. These economic impacts under Alternative 1 represent less than 1 percent of total income and total employment in the local area economy.

Table 6-21. Summary of Annual Economic Impacts for Alternative 1 (2011 dollars in thousands)

	Economic Output	Jobs	Job Income	Tax Revenue
Recreation Visits	–	–	–	–
Budget	$78.70	1	$33.50	$11.10
Total	$78.70	1	$33.50	$11.10

Table 6-22 summarizes the economic impacts for Alternative 2. Under Alternative 2, Unit activities would generate an estimated $849,000 in economic output, seven jobs, $315,200 in job income, and $116,700 in tax revenue. These economic impacts under Alternative 2 represent less than 1 percent of total income and total employment in the local area economy.

Table 6-22 Summary of Annual Economic Impacts for Alternative 2 (2011 dollars in thousands)

	Economic Output	Jobs	Job Income	Tax Revenue
Recreation Visits	$79.40	1	$24.60	$11.10
Budget	$763.90	6	$288.80	$104.80
Total	$843.30	7	$313.40	$115.90

6.3.17 Cumulative Effects at Black River Unit of Billy Frank Jr. Nisqually National Wildlife Refuge

Effects of Reasonably Foreseeable Future Refuge Activities

Alterations and loss of native habitats continue at the landscape scale as challenges such as human development and climate change pose complex and persistent threats. Within this context, region-wide biological integrity may be at risk. Over time, the Unit, although relatively small, may become increasingly valuable for the persistence of native wildlife. Active improvement of habitats would increase or maintain the value of Unit lands and waters for a wide variety of native fish and wildlife,

and biological diversity. Both alternatives protect and maintain Unit habitats valuable to wildlife; however, there is a greater emphasis on habitat enhancement and management, IPM, and pursuing priority inventory, monitoring, and research in Alternative 2.

In concert with other protected lands, the Unit has an important role to conserve resident, threatened, and rare species, as well as migratory wildlife species, and to provide places where visitors can enjoy and appreciate nature. Under Alternative 2, the Service would increase the availability and quality of wildlife-dependent recreation, contributing to increased regional recreational opportunities. Implementing the CCP would have overall beneficial effects to habitats, species, and the American public. In the context of all of the factors (both natural and human-caused) that negatively affect habitats and species (e.g., food availability, human disturbance, and contaminants) the positive contributions associated with CCP implementation represent long-term, beneficial effects.

Other Reasonably Foreseeable Events and Activities from Others

Thurston County population increased (21 percent) from 2001 to 2011, compared with a 14 percent increase for Washington and a 9 percent increase for the United States as a whole. The county population in 2011 was 256,600. The population is expected to continue its rapid rise in the local area, especially with the rapid enlargement of Joint Base Lewis-McChord. The Unit's proximity to this growing population will cause former rural land to become developed more rapidly than in the past. For example, the Unit is very close to the city complex of Olympia, Lacey, and Tumwater, has lower land values, and is an easy 5–10-mile commute. The loss of the rural, forested, agricultural, or "un-used" lands result in direct loss of remaining habitats, and indirect loss through fragmentation and degradation of the lowland's remaining parcels of wildlife habitat. These expected losses create a situation where the Unit may become increasingly valuable for the persistence of native habitats and the wildlife that rely upon them.

6.4 References

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