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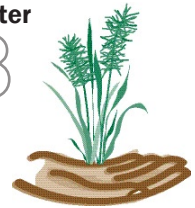https://escholarship.org/uc/item/0xs0983x

Author
Carey, Marion

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Small Mammals

ADDRESSING HABITAT FRAGMENTATION IMPACTS FROM CONSTRUCTION OF A NEW HIGHWAY

Marion Carey (Phone: 360-705-7404, Email: careym@wsdot.was.gov), Fish and Wildlife Program Manager, Environmental Services Office, Washington State Department of Transportation, Olympia, Washington

Abstract: The purpose of this project was to develop methods to analyze impacts from and find solutions for habitat fragmentation resulting from the construction of a new highway across two military bases (McChord Air Force Base and Fort Lewis Army Base). The bases contain large blocks of rare terrestrial habitats. The need to maintain the security of the bases limits the ability to use on-site methods, such as underpasses and crossing structures.

In 2003, the Crossbase highway project, which had been a Pierce County-sponsored project, was identified as a new state highway, and thus became the Washington State Department of Transportation's (WSDOT) responsibility. The six-mile-long highway cuts through two adjoining military bases to connect a heavily developed urban/industrial area with Interstate 5. Both military bases have core areas containing airfields, housing, operational, and commercial areas that are surrounded by largely undeveloped natural habitats consisting of large wetlands, coniferous forests, rare oak woodlands, and rare native prairie areas. These natural areas are bisected by an extensive network of gravel and paved roads and are used for military training activities. These rare habitats support four federal candidate species, and one state-listed endangered species. Development activities surrounding the military bases have fragmented and eliminated much of the habitats outside of the bases.

The new highway is expected to result in three main ecological impacts: direct loss of rare habitat types, decreased use of surrounding habitat due to impacts associated with the operation of the highway (e.g., noise), and habitat fragmentation or isolation of habitats. While mitigation ratios exist to address the elimination of habitats such as wetlands, no ratios or methods exist to quantify impacts associated with operation impacts or habitat fragmentation. Working in conjunction with Washington State Department of Fish and Wildlife (WDFW), WSDOT developed a method to assess these impacts based on the level of function that would be lost. This method was used to determine what the total habitat enhancement and restoration package for the Crossbase highway should be.

The resulting habitat enhancement and restoration package that was developed consists of three parts: acquisition of a large parcel of rare habitat, restoration and enhancement of the acquired site, and providing funding for additional restoration, acquisition, and enhancement activities.

While construction of the highway has not begun, WSDOT is proceeding with acquiring the restoration and enhancement site and has provided funding for the additional acquisition, restoration, and enhancement activities. The developed method will be used on other new highway projects in the future.

Introduction

WSDOT creates very few new roadways. In the last 15 years, the few "new" roads that have been constructed were bypasses around small towns where traffic levels exceeded the capacity of the highway, and the majority of the road construction activities were associated with upgrading or replacing existing infrastructure. In the early 1990s Pierce County began planning for a new highway that would connect an industrial area with Interstate 5. As the project moved through the National Environmental Protection Act (NEPA) process, the state legislature designated it a state highway, and in 2003 the responsibility for the Crossbase highway project was assigned to WSDOT.

The Crossbase highway will be a four-lane limited access highway that is six miles long. The highway crosses two adjoining military bases – Fort Lewis Army Base and McChord Air Force Base. These two large bases comprise some 86,000 acres of land in the heart of Puget Sound, between the cities of Tacoma and Olympia. Due to the layout of the bases, portions of two counties lack easy highway access. The new highway will be a limited access highway to maintain the security of the bases.

Both military bases have heavily developed core areas containing airfields, housing, operation, and commerce areas that are surrounded by largely undeveloped natural habitats consisting of large wetlands, coniferous forests, rare oak woodlands, and rare native prairie areas. These natural areas are bisected by an extensive network of gravel and paved roads and used for military training activities. Development activities outside the military bases has fragmented and eliminated much of the habitats not located on the bases. The highway will cross several rare habitat types, including Oregon white oak woodlands and native prairies.

These rare habitats support numerous rare species, four of which are listed as candidates under the Endangered Species Act, and one that is listed as a state endangered species. These are in addition to the more "common" federally listed species that on-base habitats support, such as bald eagles (*Haliaeetus leuchcephalus*), water howelli (*Howelli aquatilis*), and Puget Sound chinook salmon (*Oncorhynchus tshawytscha*). The candidate species are all associated with the prairies or oak woodland prairies interface and include two butterflies – Mardon Skipper (*Polites*

mardon) and the Whulge (Edith's) checkerspot (*Euphydryas editha taylor*); one bird – streaked horned lark (*Eremophila alestris strigata*); and one mammal – Mazama pocket gopher (*Thomomys mazama*). The western gray squirrel (*Sciurus griseus griseus*) is a state endangered species in severe decline in the Puget Sound Trough, which occurs in the oak, conifer, wetland interfaces on the bases.

There was strong opposition for the project from several environmental groups and public agencies during the NEPA process. The groups felt that the impacts from highway construction were too severe and that the no-build alternative should be selected. They were concerned that the highway would fragment the rare habitats and cause the extirpation of the western gray squirrel from the Puget Sound Region, and impact the three less mobile prairie-dependant species. There was less concern about the streaked horned lark as it is a very mobile species. Pierce County and its consultant worked hard to try to resolve the issues and created an extensive mitigation commitment in the Environmental Impact Statement (EIS). However, even when the Record of Decision was signed, there was still some opposition and disagreement on the project.

Since some of the more vocal opposition was from the WDFW, the Governor's office requested that WSDOT and WDFW come to resolution. Two teams were established: a policy team, consisting of executive level personnel from both agencies, and a team of technical experts from both agencies. The technical team worked together to develop the methods to assess impacts and also evaluated the suitability of the mitigation approach presented in the EIS. If that approach was insufficient, then the technical team was to develop a suitable habitat enhancement and restoration approach for review and approval by the executive level team. The executive level team would also settle any areas of disagreement between the two agencies that were presented by the technical level team. The technical team's methods for assessing impacts and evaluating the suitability of the mitigation approach are presented in this document.

Methods

There were two potential approaches that could be used to assess impacts: a species-based approach or a habitat-based approach. Since the EIS included extensive geographic information system (GIS) habitat information, the decision was made to evaluate impacts to habitats, rather than the species. The EIS had identified all of the habitat types in the project area and had determined the amount of each type of habitat. Habitat categories were grouped into five general categories: conifer forest, oak forest, other hardwood forest, savanna, and grassland habitat.

The first step was to identify the impacts from the project. Three impacts were identified: loss of habitat, permanently disturbed habitat, and fragmentation/isolation of habitat. The entire right of way was considered to fall under the loss of habitat category. This is habitat that the team felt would be altered to un-usable habitat even though there would still be native vegetation left intact in the outer zones of the right of way. The team determined that all areas within a half-mile of the new highway would be permanently disturbed by the presence of the highway. Disturbance from noise, stormwater, airborne pollutants, wind generated by traffic, and the edge effect were all considered when setting this distance. Only the area south of the new highway was placed into this category. The area north of the new highway was included in the third category, the fragmentation/isolation category. This included the entire non-altered habitat north of the proposed highway within the bases. Buildings, roads, parking lots and other developed areas were not included. Using GIS information, the amount of habitat (categorized by habitat type) in each of the impact categories was identified.

Table 1. Impact by Habitat Type

Habitat Type	Loss of Habitat (acres)	Permanently Disturbed (acres)	Fragmented/Isolated (acres)
Conifer forest	106	452	1208
Oak Forest	18	91	381
Other Hardwood forest	5	37	288
Savanna	7	31	318
Grassland	30	122	1332
Total Acres	166	733	3527

The technical team recognized that the habitats being evaluated were part of two very active military bases that managed their lands specifically for extensive year-round troop training exercises. Conifer forests are managed for open understories, and prairies are managed for parachute jumps, helicopter overflights, land navigational exercises, and as artillery impact areas. Since the habitat was not pristine, a functional value scale was applied to the habitat. The scale was set from 0 to 1, with 0 equaling no function (e.g., pavement), and 1 equaling intact, totally functional habitat. A value from 0.1- 0.3 was assigned to poorly functioning habitat, and a value of 0.4 –0.6 was assigned to disturbed, partially functioning habitat.

The technical team rated the function of each of the five habitats categories by evaluating the overall function based on aerial photos, site visits, and best professional judgment. The values for each habitat type were totaled in each of the three impact categories. A point value was determined for each habitat type based on the acres of habitat in the impact category multiplied by the assigned functional value (see table 2). After evaluating each habitat type, the average functional value for all the habitat in the area north of the proposed highway was calculated to be 0.5.

Table 2. Example of Calculation for Functional Value

Habitat Type	Functional Value	Loss of Habitat Impact Category (acres)	Loss of Habitat (functional value score)
Conifer Forest			
Poorly Functioning	0.1	56	5.6
Disturbed Partially Functioning	0.2	19	3.8
Intact Functioning	1.0	31	31
Total Acres		106	40.4

The next step was to evaluate the impact from the highway. Each of the three impact types was assigned a functional loss multiplier. Permanent loss of habitat was determined to be a total functional loss (100%), permanently disturbed habitat was determined to have a 10-percent loss of function, and fragmented habitat was determined to have a 20-percent loss of function. The existing functional value of the three impact categories was multiplied by the functional loss multiplier to determine the amount of habitat restoration and enhancement stewardship points that were to be provided by the project.

Table 3. Habitat Impact from Highway in Stewardship Points

Habitat Affected	Acres	Existing Functional Value	Functional Loss Multiplier	Stewardship Points
Permanently Lost	166	77	1.0	77
Disturbed	733	337	0.10	34
Fragmented	3527	2163	0.20	432
Totals	4426	2577		**543**

The team then evaluated the restoration package presented in the EIS. Since the highway was crossing two bases, Homeland Security concerns prevented the use of large under- or over-passes to help avoid fragmentation impacts. Thus, the majority of the impacts could not be addressed through on-site solutions, and needed to be addressed off site. The EIS identified a 364-acre restoration and enhancement site, and a conceptual restoration plan for the site. The site is located directly adjacent to Fort Lewis, providing an excellent opportunity to offset fragmentation and add to the total land area of the bases. The site is currently used for grazing and is degraded.

A functional assessment method was applied to the restoration site to determine its current functional value by habitat type. Then the functional value potential following restoration of the site was calculated. A functional level of 1.0 was used to represent the best possible functional value of the site. The current average functional value of the entire site is 0.36. The evaluation of the restoration site indicated that it would provide 356 habitat restoration and enhancement stewardship points, leaving a deficiency of 184 points.

Various options were discussed to finish the habitat restoration and enhancement package. The option favored by WDFW was to dedicate funding for other prairie and oak woodland habitat purchase, restoration, and enhancement efforts. This option required the assignment of a monitory value per point. Evaluation of the land prices in the area for large blocks of land helped establish a per point value of $8,152. Accordingly, $1.5 million was placed into an account under WDFW administration to assist in habitat procurement, restoration, and enhancement efforts.

Conclusions

The final habitat restoration and enhancement package for the Crossbase highway consists of the purchase of a 364-acre parcel adjacent to Fort Lewis, the establishment of a $3.5 million restoration budget with an additional $1 million contingency fund, and a $1.5 million contribution to other prairie and oak woodland habitat purchase, restoration, and enhancement efforts.

The method that the technical team developed to determine if sufficient habitat restoration and enhancement would occur to offset impacts from the highway provides a simple tool to assess habitat functions and impacts to habitats that will not be destroyed but will be impacted by disturbance or fragmentation. This method was created due to the lack of available approaches for operational and habitat fragmentation impacts to rare habitats and the limited availability of information about the species occupying the impacted habitats.

Biographical Sketch: Marion Carey is the fish and wildlife program manager for the Environmental Services Office of the Washington State Department of Transportation. Carey has been with the agency since 1994 working on a variety of fish and wildlife issues, including deer-vehicle collisions, Endangered Species Act consultations, Migratory Bird Treaty Act permits, and rare species surveys.