

Development of a Resource Planning Index for Washington's Scenic and Recreational Highways

WA-RD 740.1

Kevin Ramsey

February 2010



**Washington State
Department of Transportation**
Office of Research & Library Services

WSDOT Research Report

Development of a Resource Planning Index for Washington's Scenic and Recreational Highways

By
Kevin Ramsey, Ph.D.
University of Washington Department of Geography
University of Washington, Bx 353550
Seattle, Washington 98195

Washington State Transportation Center (TRAC)
University of Washington, Box 354802
University District Building
1107 NE 45th Street, Suite 535
Seattle, Washington 98105-4631

Washington State Department of Transportation
Technical Monitor
Paula Reeves
MCP, Local Planning Branch Manager

A report prepared for

The State of Washington
Department of Transportation
Paula J. Hammond, Secretary

February 2010

TECHNICAL REPORT STANDARD TITLE PAGE

1. REPORT NO. WA-RD 740.1		2. GOVERNMENT ACCESSION NO. 		3. RECIPIENT'S CATALOG NO. 	
4. TITLE AND SUBTITLE Development of a Resource Planning Index for Washington's Scenic and Recreational Highways			5. REPORT DATE February 2010		
7. AUTHOR(S) Kevin Ramsey			8. PERFORMING ORGANIZATION REPORT NO. 		
9. PERFORMING ORGANIZATION NAME AND ADDRESS University of Washington Office of Sponsored Programs 1100 NE 45th, Suite 300 Seattle, WA 98105-4631			10. WORK UNIT NO. 		
12. SPONSORING AGENCY NAME AND ADDRESS Research Office Washington State Department of Transportation Transportation Building, MS 47372 Olympia, Washington 98504-7370 Kathy Lindquist, Project Manager, 360-705-7976			11. CONTRACT OR GRANT NO. Agreement T4118-54		
13. TYPE OF REPORT AND PERIOD COVERED Final Technical Report			14. SPONSORING AGENCY CODE 		
15. SUPPLEMENTARY NOTES This study was conducted in cooperation with the U.S. Department of Transportation, Federal Highway Administration.					
16. ABSTRACT Washington State Department of Transportation Local Programs Division requested the creation of a Resource Planning Index (or "Index") for use in benchmarking and tracking the stewardship performance of investments associated with Washington's Scenic and Recreational Highways. A GIS analysis was performed to develop a unique Index value for each 1000 feet of roadway. The Index value was calculated based on the proximity of features of interest associated with specific opportunities for protecting, preserving, or enhancing resources associated with the state Scenic and Recreational Highways. This Index may be used in preliminary assessments of locations where there may be a confluence of such opportunities. As always, a local scale analysis of the location should assess exactly what opportunities exist there and whether a proposed project would actually provide the desired benefit or impact.					
17. KEY WORDS Scenic and Recreational Highways			18. DISTRIBUTION STATEMENT No restrictions. This document is available to the public through the National Technical Information Service, Springfield, VA 22616		
19. SECURITY CLASSIF. (of this report) <div style="text-align: center;">None</div>		20. SECURITY CLASSIF. (of this page) <div style="text-align: center;">None</div>		21. NO. OF PAGES <div style="text-align: center;">16</div>	
22. PRICE 					

Development of a Resource Planning Index for Washington’s Scenic and Recreational Highways

Contents

1. INTRODUCTION	1
2. IDENTIFICATION OF OPPORTUNITIES.....	2
3. DATA COLLECTION AND QUALITY ASSURANCE	4
4. INDEX CALCULATION METHODOLOGY.....	10
5. IDENTIFICATION OF LOCATIONS OF HIGHEST POTENTIAL	11
6. LIMITATIONS OF THE RESOURCE PLANNING INDEX.....	12
7. RECOMMENDED USE OF THE RESOURCE PLANNING INDEX.....	13

Table 1	Data Included in the Resource Planning Index Analysis.....	5
---------	--	---

Figure 1	Resource Planning Index Values for Scenic and Recreational Highways	14
----------	---	----

Figure 2	Locations of Highest Potential for Protecting, Preserving, and Enhancing Resources Associated with Washington Scenic and Recreational Highways	15
----------	--	----

1. INTRODUCTION

Washington State Department of Transportation Local Programs Division requested the creation of a Resource Planning Index for use in benchmarking and tracking the stewardship performance of investments associated with Washington's Scenic and Recreational Highways. For the purpose of this study, **stewardship** is defined as "protecting, preserving, and enhancing resources associated with the state Scenic and Recreational Highways."¹ These resources may be scenic (e.g., view shed), environmental (e.g. ecosystems, water quality, or wildlife habitats), or historic (e.g. historic locations). The Resource Planning Index (or "Index") provides a rough measure of the potential for locations along Scenic and Recreational Highways to benefit from stewardship-oriented projects.

The State Scenic and Recreational Highway System was established by the State Legislature based on a 1962 "visual quality assessment" of state highways. This assessment identified and selected state highways with significant scenic resources. Visual assessments were conducted two additional times before 1990, confirming the state's Scenic and Recreational Highway System. This study compiles available GIS data to build on the visual assessments of the past.

WSDOT recognizes that projects intended to serve the goal of increasing tourism or economic development may or may not also serve the goal of stewardship. WSDOT also recognizes that there is an opportunity to increase emphasis on accomplishing both tourism/economic development and stewardship. This analysis focuses exclusively on the goal of stewardship. More detailed and local-scale analysis conducted as part of corridor plan or other plans will be required to evaluate whether individual investments can address the goals of both stewardship and tourism/economic development. The findings from this statewide analysis of stewardship potential are preliminary. These findings should be used as a 'first cut' guide to highlight areas in the Scenic and Recreational Highway System that have a high potential for protecting, preserving, and enhancing resources associated with the state Scenic and Recreational Highways.

¹ Steering Committee Meeting, State Scenic and Recreational Highway Plan, September 24, 2009; p. 3.

2. IDENTIFICATION OF OPPORTUNITIES

The first step in this analysis was to identify different kinds of opportunities for protecting, preserving, or enhancing resources associated with the state Scenic and Recreational Highways. These opportunities take into consideration the kinds of impacts that highways can have on scenic, environmental, and historic resources as well as ways in which those impacts can be mitigated. Opportunities considered in this analysis are listed as follows:

- ***Enhancing the viability of existing habitats and ecosystems***
Scenic and recreational highways have inevitable impacts on the existing habitats and ecosystems in their proximity including storm water run-off, watershed function, noise and air pollution, habitat fragmentation, and facilitating the development of unprotected lands. Areas with existing habitats and ecosystems provide opportunities to mitigate potential impacts through stewardship projects including overlay zones, the purchase of land or conservation easements, or roadway design improvements that mitigate sound, air, or water pollution resulting from roadway traffic.
- ***Enhancing the viability of known habitat corridors***
Numerous “species of concern” in Washington State need to move between habitat areas to survive, reproduce, and maintain their genetic fitness. Identification of priority habitat corridors for Grizzly Bear, Wolf, Canada Lynx, and Wolverine has been completed. However, a more comprehensive effort is underway and likely to produce map products by the end of 2010. Maintaining suitable conditions in identified corridors throughout the state is crucial to habitat connectivity and the long term health of many wildlife populations. Scenic and recreational highways, and the development of land to which they provide access, may impact habitat connectivity. Investments such as roadside habitat preservation or (in the case of major highways) bridges for wildlife passage can mitigate these impacts and enhance the viability of habitat corridors.
- ***Reducing impacts to species at particular risk of road kills***
Some priority habitat areas within Washington contain species that are at particular risk to collisions with vehicles on sections of scenic and recreational highways. For instance, several reptile species move slowly and are attracted to the heat emanated by road surfaces at night.² Areas rich with these species provide opportunities for roadway design improvements that can help to reduce road kills.
- ***Enhancing the viability aquatic and riparian habitat***
Scenic and recreational highways, as well as the development of land to which they provide access, may have implications for the viability of aquatic and riparian habitat. A majority of fish and wildlife species in Washington

² According to Kelly McAllister, Habitat Connectivity Biologist at WSDOT.

depend on aquatic and riparian ecosystems for all or part of their life cycle.³ This includes a number of federally listed endangered and threatened species, such as salmon. Opportunities to mitigate impacts on these ecosystems may include improved culvert design for fish passage, improved management and treatment of roadway runoff, riparian habitat restoration along scenic and recreational highways, and protection of aquatic or riparian habitats near scenic and recreational highways.

- ***Reducing impacts to places of scenic, cultural, and historic significance***
Places of scenic, cultural, and historic significance in Washington State can be detrimentally impacted by highway traffic and development pressures. Specific impacts include noise and air pollution as well as nearby development that can alter the character of these places. Such impacts can be reduced or mitigated by historic preservation, the purchase of land or conservation easements to preserve view sheds, or improved roadway design.

This analysis assumes locations with multiple opportunities for protecting, preserving, and enhancing resources associated with the state Scenic and Recreational Highways have a higher potential for benefits than other locations. In other words: the more opportunities that exist in a location, the higher the potential for benefit. Locations with high potential will be assigned a correspondingly higher Index value and corresponding color on the map (see Figure 1).

³ Washington Department of Fish and Wildlife, 2003. "Design of Road Culverts for Fish Passage", <http://wdfw.wa.gov/hab/engineer/cm/>

3. DATA COLLECTION AND QUALITY ASSURANCE

Existing spatial data resources relevant to determining areas with high potential for protecting, preserving, and enhancing resources associated with the state Scenic and Recreational Highways were collected and assessed for quality. Table 1 includes a listing of all data used in the development of the Resource Planning Index. These data are grouped as *features of interest* that are associated with specific opportunities identified in Section 2.

Table 1: Data Included in the Resource Planning Index Analysis

Feature of Interest	Relevant Opportunity	Data Title	Data Source	Data Description
Protected areas	<i>Enhancing the viability of existing habitats and ecosystems</i>	Natural Area Preserves (NAP)	Dept. of Natural Resources	Polygon data describing the location of NAPs in Washington. NAPs “protect the best remaining examples of many ecological communities including rare plant and animal habitat.” ⁴ These areas are not intended for recreational purposes.
	<i>Enhancing the viability aquatic and riparian habitat</i>	Natural Resource Conservation Areas (NCRA)	Dept. of Natural Resources	Polygon data describing the location of NCRAs in Washington. “Conservation areas protect outstanding examples of native ecosystems, habitat for endangered, threatened and sensitive plants and animals, and scenic landscapes. Environmental education and low impact public use are appropriate on conservation areas where they do not impair the resource values of the area protected.” ⁵
		Wildlife areas and refuges	Dept. of Fish and Wildlife	Polygon data describing protected areas designated for wildlife conservation.
	<i>Reducing impacts to places of scenic, cultural, and historic significance</i>	National Parks	National Park Service	Polygon data describing the location of National Parks in Washington. National Parks are tourism and recreational destinations that preserve natural and cultural resources.
		WA State Parks	State Parks	Polygon data describing the location of State Parks in Washington. State parks are tourism and recreational destinations that preserve natural and cultural resources.
		USFS Wilderness Areas	USFS	Polygon data describing the location of federally designated Wilderness Areas in Washington State. These public lands are protected from all development and allow only for low impact recreation.
		TNC nature preserves	TNC	Polygon data describing the location of all preserves owned and managed by The Nature Conservancy. These preserves are open to the public for low impact recreational activities.
		National Recreation Areas	WSDOT	Polygon data describing the location of all National Recreation Areas in Washington.

⁴ http://www.dnr.wa.gov/ResearchScience/Topics/NaturalAreas/Pages/amp_na.aspx

⁵ http://www.dnr.wa.gov/ResearchScience/Topics/NaturalAreas/Pages/amp_na.aspx

Priority Habitat Areas	<i>Enhancing the viability of existing habitats and ecosystems</i>	Talus slope	Dept. of Fish and Wildlife	Polygon data describing talus slope habitats in Washington State. According to Kelly McAllister, Habitat Connectivity Biologist, “this habitat type captures some of the more reptile rich areas in Washington which is significant for highways since reptiles are subject to elevated road kill risk due to their slow moving nature and attraction to heat being emanated, at night, from road surfaces.”
		Shrub steppe	Dept. of Fish and Wildlife	Polygon data describing shrub steppe habitats in Washington State. Habitat recommended for consideration by Kelly McAllister, Habitat Connectivity Biologist due to the many species of concern associated with this rare and declining habitat type.
		Prairie	Dept. of Fish and Wildlife	Polygon data describing prairie habitats in Washington State. Habitat recommended for consideration by Kelly McAllister, Habitat Connectivity Biologist due to the many species of concern associated with this rare and declining habitat type.
Natural Heritage Areas	<i>Enhancing the viability of existing habitats and ecosystems</i>	Natural Heritage Areas	Dept. of Natural Resources	Polygon data describing areas with rare plants and ecological communities that have been prioritized for conservation efforts by Washington Natural Heritage Program (WNHP) within the Department of Natural Resources. ⁶ These areas are likely to be unsuitable for recreation-oriented investments (due to impacts of people-traffic on wildlife).
Wildlife corridors	<i>Enhancing the viability of known habitat corridors</i>	Lynx corridors	UW	Raster data regarding landscape permeability for lynx in Washington State. Cells are valued based on a habitat connectivity analysis conducted by biologist Peter Singleton. Locations that are most viable as habitat corridors are given the highest value. Source habitats for lynx were also included in this analysis and treated as corridors of highest viability.
		Wolf corridors	UW	Raster data regarding landscape permeability for wolves in Washington State. Cells are valued based on a habitat connectivity analysis conducted by biologist Peter Singleton. Locations that are most viable as habitat corridors are given the highest value. Source habitats for wolves were also included in this analysis and treated as corridors of highest viability.
		Wolverine corridors	UW	Raster data regarding landscape permeability for wolverines in Washington State. Cells are valued based on a habitat connectivity analysis conducted by biologist Peter Singleton. Locations that are most viable as habitat corridors are given the highest value. Source habitats for wolverines were also included in this analysis and treated as corridors of highest viability.

⁶ http://www.dnr.wa.gov/ResearchScience/Topics/NaturalHeritage/Pages/amp_nh.aspx

		Grizzly bear corridors	UW	Raster data regarding landscape permeability for grizzly bears in Washington State. Cells are valued based on a habitat connectivity analysis conducted by biologist Peter Singleton. Locations that are most viable as habitat corridors are given the highest value. Source habitats for grizzly bears were also included in this analysis and treated as corridors of highest viability.
Lakes, wetlands, rivers and streams	<i>Enhancing the viability aquatic and riparian habitat</i>	Streams and rivers	Dept. of Ecology	Arc data regarding streams and rivers listed in the Washington Shoreline Management act. ⁷ A 1000 foot buffer around these areas was created for the purpose of analysis.
		Lakes and wetlands	Dept. of Ecology	Polygon data regarding lakes and wetlands listed in the Washington Shoreline Management act. ⁸ A 1000 foot buffer around these areas was created for the purpose of analysis.
Impacted waterways	<i>Enhancing the viability aquatic and riparian habitat</i>	Class 2 impacted waterways	Dept. of Ecology	Polygon data describing “waters of concern”. These waterways have evidence of water quality degradation. A 1000 foot buffer around these areas was created for the purpose of analysis.
		Class 4 (A, B, & C) impacted waterways	Dept. of Ecology	Polygon data describing polluted waters that do not require a TMDL (Total Maximum Daily Load). A 1000 foot buffer around these areas was created for the purpose of analysis.
		Class 5 impacted waterways	Dept. of Ecology	Polygon data describing polluted waters that require a TMDL (Total Maximum Daily Load). A 1000 foot buffer around these areas was created for the purpose of analysis.
Fish barriers	<i>Enhancing the viability aquatic and riparian habitat</i>	Fish Barriers	WSDOT	Point data of locations where fish passage across WA roadways is impeded

⁷ ftp://www.ecy.wa.gov/gis_a/shore/sma-arcs.zip

⁸ ftp://www.ecy.wa.gov/gis_a/shore/sma-arcs.zip

Historic locations	<i>Reducing impacts to places of scenic, cultural, and historic significance</i>	Nationally registered historic locations	Dept. of Archeology and Historic Preservation	Point data describing nationally registered historic places in Washington State. These locations are being preserved for their historic significance. A 1000 foot buffer around these areas was created for the purpose of analysis.
Current and future land use	<i>Enhancing the viability of existing habitats and ecosystems</i>			
		Benton County	Benton Co.	Visual inspection of online comprehensive plan map ⁹ indicates no conflict with areas of high stewardship potential.
	<i>Enhancing the viability aquatic and riparian habitat</i>	Chelan County	UW	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
		Clallam County	UW	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
		Clark County	Clark Co.	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
	<i>Reducing impacts to culturally and historically significant places</i>	Franklin County	Franklin Co.	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
		Grant County	Grant Co.	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
		Grays Harbor County	Grant Co.	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
		Jefferson County	Jefferson Co.	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
		King County	King Co.	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
		Kitsap County	UW	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
		Klickitat County	UW	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.

⁹ http://www.co.benton.wa.us//UltimateEditorInclude/UserFiles/Common/Document/Benton_County_COM_PLAN_12-03-2009_120238.pdf

	Mason County	UW	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
	Okanogan County	UW	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
	Pacific County	Pacific Co.	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
	Pierce County	Pierce Co.	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
	San Juan County	<i>San Juan Co.</i>	<i>Zoning data received from county. Metadata not yet available for review.</i>
	Skagit County	Skagit Co.	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
	Snohomish County	Snohomish Co.	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
	Spokane County	Spokane Co.	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
	Stevens County	UW	Zoning data received from UW. No metadata is available to assess its relevance to stewardship priorities. Therefore it is not included in this analysis.
	Thurston County	UW	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
	Watcom County	Watcom Co.	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.
	Yakima County	UW	Polygon data regarding parcels zoned or planned for commercial, industrial, or business park development.

4. INDEX CALCULATION METHODOLOGY

The data sets listed in Table 1 of this report were analyzed to create a unique data set called a Resource Planning Index for the purpose of this report. This Index assigns values to locations along Scenic and Recreational Highways based on the potential to protect, preserve, or enhance resources associated with the state Scenic and Recreational Highways. The Index data is organized in the form of a raster grid with cells that correspond to 1000 feet on the ground.

The Index value for each is calculated based on the presence (or in some cases, proximity) of a feature of interest that is relevant to an opportunity to protect, preserve, or enhance resources associated with the state Scenic and Recreational Highways (see Section 2 and Table 1 above). If a cell intersects multiple features of interest, its Index value will be higher. All features of interest are weighed equally in this analysis, with the exception of wildlife corridors. The weight assigned for these corridors is graduated based on each cell's viability as a wildlife corridor (see data description in Table 1 above). Highest viability cells are given the same weight as every other feature of interest. Less viable cells are given proportionally less value. The calculation of Index values is described here:

- +10 if a cell is within a protected area
- +10 if a cell is within a Priority Habitat Area of concern
- +10 if a cell is within a Natural Heritage Area
- Up to + 10 if cell is within a grizzly wildlife corridor or source habitat
- Up to + 10 if cell is within a lynx wildlife corridor or source habitat
- Up to + 10 if cell is within a wolf wildlife corridor or source habitat
- Up to + 10 if cell is within a wolverine wildlife corridor
- +10 if a cell is within 1000 feet of a SMA-listed lake, wetland, river, or stream
- +10 if cell is within 1000 feet of an 'impacted' waterway
- +10 if cell contains a fish barrier
- +10 if cell is within 1000 feet of a registered historic location
- Exclude all cells within parcels zoned for commercial, industrial, business park, or airport development.

5. IDENTIFICATION OF LOCATIONS OF HIGHEST POTENTIAL

Figure 1 represents Resource Planning Index values for each 1000 foot segment of the state Scenic and Recreational Highways.¹⁰ The range of Index values along these roadways is 0 to 50. This data was then analyzed to isolate the segments that have the highest potential for preserving, and enhancing resources associated of Scenic and Recreational Highways. Roadway segments with clusters of cells in the top 40% of the Index range (30 or higher) were identified. These areas are represented in Figure 2. For ease of readability Figure 2 *does not* symbolize isolated cells with values of 30 or higher. For raw Index values throughout the Scenic and Recreational Highway System, including an accounting of all cells with values over a particular threshold, it is necessary to consult the original raster layer created for this analysis.

¹⁰ For map readability, the 1000-foot cells were expanded by one cell in each direction. To recover precise measurements for points along Scenic and Recreational Highways is will be necessary to return to the original GIS data.

6. LIMITATIONS OF THE RESOURCE PLANNING INDEX

As with any statewide GIS analysis, this Index has a number of limitations that must be considered whenever it is used. First, the data available provide only an imperfect assessment of a location's opportunities for protecting, preserving, or enhancing resources associated with the state Scenic and Recreational Highways. For instance not all protected areas have equal viability as functioning ecosystems or habitats. Nor do all rivers, lakes, and wetlands have equal viability as riparian habitats. Yet this analysis treats all such places equally and with equal weight and assumes that these areas can equally benefit. Again, this may not necessarily be the case. However, it does provide a new data set and a method for benchmarking and tracking progress that can serve to support the visual assessments of scenic qualities conducted in the past.

There are also issues around the completeness of statewide data. For instance, wildlife habitat corridor data is only available for four rare forest carnivores. There are many other species of concern for which habitat connectivity and corridor data is not currently available. Additional corridor identification work is in progress and the first GIS outputs will be available in late 2010. Likewise data regarding Priority Habitat Areas is shaped by the interests, priorities, and abilities of field biologists who conduct field surveys to collect data about such areas. There may be other habitats that are significantly impacted by scenic and recreational highways that are not considered in this analysis. Finally land use data that is collected at the county level may vary in accuracy, currency, and definitions. Fortunately, county-level zoning data is only used to *eliminate* areas from consideration rather than boost Stewardship Index values. Therefore this particular limitation has only minor significance to overall Stewardship Index values

There are also limitations to the Index as a measure of a location's potential for benefit. What the Index measures is simply the proximity or absence of particular features of interest. These features of interest are associated with various opportunities for protecting, preserving, or enhancing resources associated with the state Scenic and Recreational Highways. Therefore locations with higher Index values roughly measure the number of different opportunities that may be collocated in a particular cell or area. However, it is important to be clear that the Index does not necessarily measure or describe the priority of a location.

7. RECOMMENDED USE OF THE RESOURCE PLANNING INDEX

There are a number of ways in which the Index could be used. The most appropriate use is as follows:

- ***Identification of appropriate locations for focus***

The Index is a first-pass assessment of locations where there may be a confluence of opportunities for protecting, preserving, or enhancing resources associated with the state Scenic and Recreational Highways. Therefore, if the goal of an investment is to address multiple opportunities at once, the Index can be used to roughly determine whether or not a location may be appropriate for this goal. As always, a local scale analysis of the location should assess exactly what opportunities exist there and whether a proposed project would actually provide the desired benefit or impact to the location.



Figure 1: Resource Planning Index Values for Scenic and Recreational Highways



Figure 2: Locations of Highest Potential for Protecting, Preserving, and Enhancing Resources Associated with Washington Scenic and Recreational Highways