NORTHERN GOSHAWK (*Accipiter gentilis*) MODEL APPLICATION AND ASSESSMENT OF RESULTS

Introduction

The northern goshawk was selected as a focal species to represent species of conservation concern whose source habitat includes a wide range of forest types with a component of large trees. Goshawks are widely distributed across the forested portions of the planning area (Gilligan et al. 1994). Human disturbance was identified as a risk factor like many other species in this group.

Model Variable Descriptions

Source Habitat

The northern goshawk uses a complex mosaic of landscape conditions to meet various life history requirements for nesting, post-fledgling, and foraging (Reynolds et al. 1992). Goshawk nesting habitat in eastern Washington and Oregon was generally composed of mature and older forests (McGrath et al. 2003). Nest stands were typically composed of a relatively high number of large trees, high canopy closure (>50%), multiple canopy layers, and a relatively high number of snags and downed wood (Finn 1994, McGrath et al. 2003).

Post-fledgling areas contain the nest area(s) and are areas of concentrated use by adult females and developing juveniles after fledgling and prior to natal dispersal (Reynolds et al. 1992, Kennedy et al. 1994). Post-fledgling areas surround and include the nesting area and provide foraging opportunities for adult females and fledgling goshawks, as well as cover for fledglings (Reynolds et al. 1992, Kennedy et al. 1994). Post-fledgling areas in eastern Washington and Oregon were composed largely of structurally complex late-successional forests (McGrath 1997).

Changes in forest structure due to fire exclusion within the dry forest cover types may seem to increase the availability of source habitat for the goshawk. However, they may not be as valuable as the more open habitats they replaced because the in-growth of small trees may obstruct flight during foraging, suppress growth of large trees needed for nesting, and reduce the growth of herbaceous understory that provides habitat for prey (Reynolds et al. 1992).

We modeled goshawk source habitat using the following variables that were available in our GIS data layers:

- Potential Vegetation Types: dry ponderosa pine, dry Douglas fir, dry grand fir, cool moist, cold dry
- Tree Size : >15 inches DBH
- Layers: Single/multistory,
- Canopy Closure: >40% dry types, >60% cool moist, cold dry

Goshawks forage in a variety of forest types; however several studies have shown the importance of mid to late successional forests as foraging habitat for goshawks (Austin 1993, Bright-Smith and Mannan 1994, Hargis et al. 1994, Beier and Drennen 1997, Patla 1997, Daw and DeStefano 2001, Finn et al. 2002 a, b, Drennan and Beier 2003, Desimone and DeStefano 2005). Results from Beier and Drennen (1997) supported the hypothesis that goshawk morphology and behavior are adapted for hunting in moderately dense, mature forests, and that prey availability (as determined by the occurrence of favorable vegetation structure) is more important than prey density in habitat selection. Salafsky and Reynolds (2005) showed that goshawk productivity was related to prey availability, especially critical prey species. Taken together, these studies show the importance of habitat structure to goshawk foraging behavior and productivity.

Late-Successional Forest

Because of the importance of late-successional forests in many of the life history stages of the goshawk, we chose to map late-successional forests as a factor that influenced the quality of source habitat. We modeled late-successional forest habitats using the following variables that were available in our GIS data layers:

- Potential Vegetation Types: dry ponderosa pine, dry Douglas fir, dry grand fir, cool moist, cold dry
- Tree Size : >20 inches DBH
- Layers: Single/multistory,
- Canopy Closure: >40% dry types, >60% cool moist, cold dry

We then categorized the amount of source habitat composed of late-successional forest as follows:

Zero = late-successional forest in source habitat
Low = >0-20% of the source habitat in late-successional forest
Moderate = >20-50% of the source habitat in late-successional forest
High = >50% of the source habitat in late-successional forest

Habitat Effectiveness

Human disturbances at goshawk nest sites have been suspected as a cause of nest abandonment (Reynolds et al. 1992). In addition, roads and trails may facilitate access for falconers to remove young from nests (Erdman et al. 1998). Wisdom et al. (2000) identified habitat fragmentation or habitat loss as a forest road-associated factor for goshawks. In addition, roads may increase the likelihood of the removal of snags for safety and firewood collection, which could have negative effects on the prey base for goshawks (Wisdom et al. 2000). However, Grubb et al. (1998) reported that vehicle traffic with a noise level of <54 decibels on roads >400m from nest sites did not result in discernable behavioral response by goshawks in forested habitats.

Because of these potential influences of forest roads on goshawk source habitat, we used the late-successional forest habitat disturbance index described in Gaines et al. (2003). This index buffers open roads and motorized trails that occur within source habitat by 200 meters on each side, and non-motorized trails that occur within source habitat by 100 meters on each side. The amount of source habitat that was influenced by human activities was then categorized as follows for each watershed:

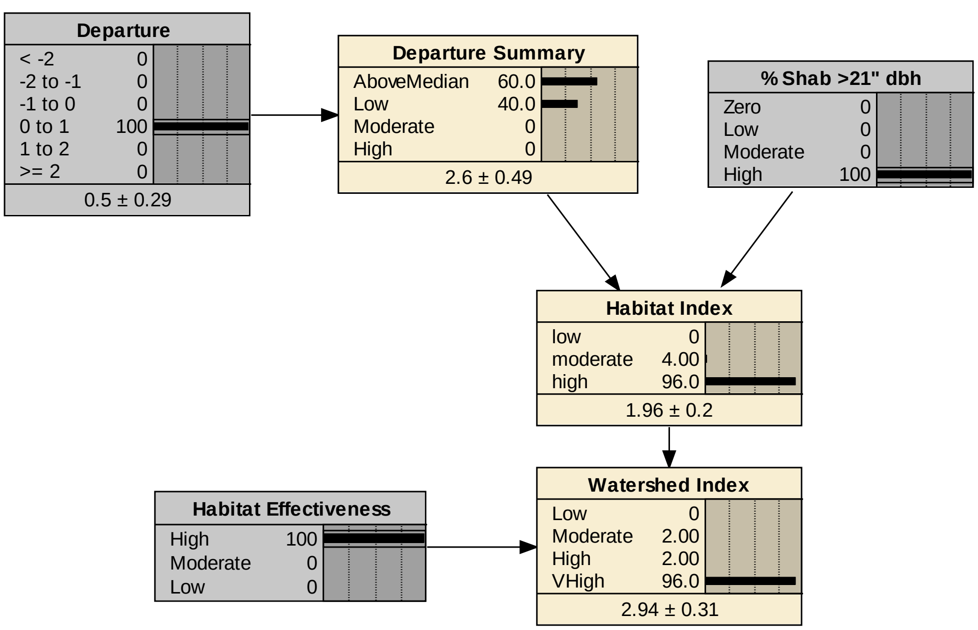
Low habitat effectiveness = <50% of the source habitat outside a zone of influence
Moderate habitat effectiveness = 50-70% of the source habitat outside a zone of influence
High habitat effectiveness = >70% of the source habitat outside a zone of influence

Historical Inputs for Focal Species Assessment Model

Departure of source habitat from departure class – Class 1

Late successional habitat – High

Habitat effectiveness - High



Figure—Focal species assessment model for northern goshawk

Relative Sensitivity of model to variables

Table -- Relative sensitivity of watershed index values to variables in the model for Northern Goshawk

Model Variables	Order of Variable Weighting
Source Habitat	**1**
Late-successional Forest	**2**
Habitat Effectiveness	**3**

Assessment Results

Watershed Index Scores

Nearly all of the watersheds had watershed index scores that were high (>2.0). Our assessment showed that the departure in the amount of source habitat from the expected historical median amount was the variable with the most influence on the northern goshawk watershed scores and this has not changed much from historical. More watersheds have increased habitat above the historical median than those that have lost habitat.

	UMA			WAW			MAL		
Departure Class	# Hucs	%Hucs		# Hucs	%Hucs		# Hucs	%Hucs	
-3	0	0		0	0		0	0	
-2	1	3		4	8		1	3	
-1	4	13		18	37		2	6	
1	9	30		16	33		7	21	
2	10	33		10	20		16	47	
3	6	20		1	2		8	24	
Total	30			49			34		

The amount of source habitat that was in a late-successional stage was high overall (see Table X).

Habitat effectiveness was indexed by buffering the amount of source habitat adjacent to roads (Gaines et al. 2003). Habitat effectiveness for goshawks was considered to be primarily low in most watersheds on all 3 Forests (See Table X).

		% Habitat in Large trees				Habitat Effectiveness		
	# Watersheds	Zero	Low	Moderate	High	Low	Moderate	High
UMA	30	0%	20% (n=6)	30% (n=9)	50% (n=15)	57% (n=17)	37% (n=11)	7% (n=2)
WAW	41	6% (n=3)	4% (n=2)	51% (n=25)	39% (n=19)	67% (n=33)	22% (n=11)	10% (n=5)
MAL	34	0%	0%	21% (n=7)	79% (n=27)	91% (n=31)	6% (n=2)	3% (n=1)
Blue Mtns	108	3% (n=3)	7% (n=8)	35% (n=38)	55% (n=59)	72% (n=78)	20% (n=22)	7% (n=8)

Table X –Percentage of watersheds in different classes of amount of source habitat in large trees, and different levels of habitat effectiveness

Viability Outcome Scores

The VO model incorporated the weighted WI (WWI) scores (described earlier), and a habitat distribution index. The Weighted Watershed Index (WWI) provides a relative measure across watersheds of the potential capability of the watershed to contribute to the viability of the focal species. The current WWI was above 80% of the Historical WWI on all 3 Forests.

Currently the watersheds with >40% of the historical median amount of source habitat were distributed across all of the clusters, as was the case historically. Dispersal across the planning area was not considered an issue for this species.

Viability Outcome	Umatilla NF		Wallowa-Whitman NF		Malheur NF	
	Historical	Current	Historical	Current	Historical	Current
HisWWI/CurWWI	100	99	100	83	100	132
%Hucs >=40%	73	73	76	71	82	79
Clusters	3/3	3/3	4/4	4/4	3/3	3/3
A	80	76	80	76	85	80
B	14	16	14	16	11	14
C	5	7	5	7	4	5
D	1	1	1	1	1	1
E	0	0	0	0	0	0

Figure --Current and historical viability outcomes for the northern goshawk

The current Viability Outcome (VO) for the planning area is primarily an "A", similar to what we projected the outcome to be historically on all 3 Forests. An "A" outcome is defined as where suitable environments are broadly distributed and of high abundance.

Alternative B Viability Analysis

We evaluated the viability for Northern goshawk for Alternative B in 2 time periods (year 20, and year 50) using the outputs of vegetation modeling. We assumed habitat effectiveness remained the same through all time periods.

The amount of source habitat generally increases across the Blue Mountains under Alternative B. The viability outcome remains high with primarily an A outcome at both year 20 and year 50.

Viability Outcome	Umatilla NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		386,807	479,402	427,170
A	80	76	80	80
B	14	16	14	14
C	5	7	5	5
D	1	1	1	1
E	0	0	0	0

Viability Outcome	Wallowa-Whitman NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		440,273	587,699	563,859
A	80	76	85	85
B	14	16	11	11
C	5	7	4	4
D	1	1	1	1
E	0	0	0	0

Viability Outcome	Malheur NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		377,762	473,069	498,236
A	85	80	85	85
B	11	14	11	11
C	4	5	4	4
D	1	1	1	1
E	0	0	0	0

In summary, likely the viability outcome under Alternative B will remain primarily an A across all 3 planning areas. Additionally, there are several plan components that describe protections and conservation measures that should benefit this species (see Table below).

WLD-HAB-2 G-2	**Guideline** Areal extent of existing late old structure stands within the moist and cold old forest types that are 300 acres or larger should not be reduced or fragmented.
WLD-HAB-7 G-9	**Guideline** Management activities should not alter stand structure within a radius of 660 feet from known goshawk nests.
WLD-HAB-8 G-10	**Guideline** Nest disturbing management activities should not occur within a radius of 1,320 feet from known active goshawk nests between April 1 and August 1.
WLD-HAB-10 *New*	**Guideline** Northern goshawk home range establishment: Post-fledgling family areas will be approximately 600 acres in size. Post-fledgling family areas will include the nest sites and consist of the habitat most likely to be used by the fledglings during their early development. Establish a minimum of three nest areas and three replacement nest areas per post-fledgling family area. The nest areas and replacement nest areas should be approximately 30 acres in size. A minimum total of 150 acres of nest areas should be identified within each post-fledgling family area. Nest site selection will be based first on using active nest sites followed by the most recently used historical nest areas. When possible, all historical nest areas should be maintained. Manage for nest replacement sites to attain sufficient quality and size to replace the three suitable nest sites.
WLD-HAB-11 G-11	**Guideline** To the extent practical, known cavity or nest trees should be preserved when conducting prescribed burning activities, mechanical fuel treatments, and silvicultural treatments.
OF-1 G-59	**Guideline** Management activities in old forest stands should retain live old forest trees (≥ 21 inches DBH). Exceptions include: • old forest tree(s) need to be removed to favor hardwood species, such as aspen or cottonwood, or other special habitats • old forest late seral species, such as grand fir, are competing with large diameter early seral species, such as ponderosa pine • old forest tree(s) need to be removed to reduce danger/hazard trees along roads and in developed sites • a limited amount of old forest trees need to be removed where strategically critical to reinforce and improve effectiveness of fuel reduction in WUIs
OF-2 G-60	**Guideline** Management activities in non-old forest stands should retain live legacy old forest trees (≥ 21 inches DBH). Exceptions to retaining live legacy old forest trees are the same as those noted in the previous guideline (OF-1).
OF-3	**Guideline** New motor vehicle routes should not be constructed within old forest stands.

REFERENCES

Austin, K. 1993. Habitat use and home range size of breeding northern goshawks in the southern Cascades. Thesis, Oregon State University, Corvallis, Oregon.

Beier, P., and J.E. Drennen. 1997. Forest structure and prey abundance in foraging areas of northern goshawks. Ecological Applications 7(2): 564-571.

Bright-Smith, D.J., and R.W. Mannan. 1994. Home range and habitat characteristics of male northern goshawks. Studies in Avian Biology 16:58-65.

Daw, S.K., and S. DeStefano. 2001. Forest characteristics of northern goshawk nest stands and post-fledgling areas in Oregon. Journal of Wildlife Management 65: 59-65.

Desimone, S.M., and D.W. Hays. 2003. Northern goshawk. Pages 6-1 to 6-16 in Management Recommendations for Washington’s Priority Habitats and Species. Volume IV: Birds. Washington Department of Fish and Wildlife, Olympia, Washington.

Desimone, S.M., and S. DeStefano. 2005. Temporal patterns of northern goshawk nest area occupancy and habitat: a retrospective analysis. Journal of Raptor Research 39(3): 310-323.

Drennen, J.E., and P. Beier. 2003. Forest structure and prey abundance in winter habitat of northern goshawks. Journal of Wildlife Management 67: 177-185.

Erdman, T.C., D.F. Brinker, J.P. Jacobs [and others]. 1998. Productivity, population trend, and status of northern goshawks, *Accipiter gentilis*, in northeastern Wisconsin. The Canadian Field Naturalist. 112(1): 17-27.

Finn, S.P. 1994. Northern goshawk nest stand characteristics in Okanogan County, Washington. Unpublished Report, Washington Department of Fish and Wildlife, Ephrata, Washington.

Finn, S.P., J. Marzluff, and D.E. Varland. 2002a. Effects of landscape and local habitat attributes on northern goshawk site occupancy in western Washington. Forest Science 48: 1-10.

Finn, S.P., D.E. Varland, and J. Marzluff. 2002b. Does northern goshawk breeding occupancy vary with nest-stand characteristics on the Olympic Peninsula, Washington? Journal of Raptor Research 36:265-279.

Gaines, W.L., P.H. Singleton, and R.C. Ross. 2003. Assessing the cumulative effects of linear recreation routes on wildlife habitats on the Okanogan and Wenatchee National Forests. USDA Forest Service, Pacific Northwest Research Station, PNW-GTR-586.

Gilligan, J., M. Smith, D. Rogers, and A. Contreras. 1994. Birds of Oregon: status and distribution. Cinclus Publ. McMinnville, OR.

Grubb, T.G., L.L. Pater, and D.K. Delaney. 1998. Logging truck noise near nesting northern goshawks. USDA Forest Service, Rocky Mountain Research Station, RMRS-RN-3.

Hargis, C.D., C. McCarthy, and R.D. Perloff. 1994. Home ranges and habitats of northern goshawks in eastern California. Studies in Avian Biology 16: 66-74.

Kennedy, P.L., J.M. Ward, G.A. Rinker, and J.A. Gessaman. 1994. Post-fledgling areas in northern goshawk home ranges. Studies in Avian Biology 16: 75-82

McGrath, M.T. 1997. Northern goshawk habitat analysis in managed forest landscapes. Thesis, Oregon State University, Corvallis, Oregon.

McGrath, M.T., S. DeStefano, R.A. Riggs, L.L. Irwin, and G.J. Roloff. 2003. Spatially explicit influences on northern goshawk nesting habitat in the interior Pacific Northwest. Wildlife Monograph 154: 1-63.

Patla, S.M. 1997. Nesting ecology and habitat of the northern goshawk in undisturbed and timber harvest areas on the Targhee National Forest, Greater Yellowstone Ecosystem. Thesis, Idaho State University, Pocatello, Idaho.

Reynolds, R.T., R.T. Graham, M.H. Reiser, R.L. Bassett, P.L. Kennedy, D.A. Boyce, G. Goodwin, R. Smith, and E.L. Fisher. 1992. Management recommendations for the northern goshawk in the southwestern United States. USDA Forest Service, Rocky Mountain Research Station, GTR-RM-217.

Salafsky, S.R., and R.T. Reynolds. 2005. Patterns of temporal variation in goshawk reproduction and prey resources. Journal of Raptor Research 39(3): 237-246.

Squires, John R. and Richard T. Reynolds. 1997. Northern Goshawk (Accipiter gentilis), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/298

Wisdom, M.J., R.S. Holthausen, B.C. Wales [and others]. 2000. Source habitats for terrestrial vertebrates of focus in the interior Columbia basin: broad-scale trends and management implications. USDA Forest Service, Pacific Northwest Research Station, PNW-GTR-485.

Woodbridge, B., and P.J. Dietrich. 1994. Territory occupancy and habitat patch size of northern goshawks in the southern Cascades of California. Studies in Avian Biology 16: 83-87.

CASSIN'S FINCH (*Carpodacus cassinii*) MODEL APPLICATION AND ASSESSMENT OF RESULTS

Introduction

Cassin's finch is a focal species for Medium and Larger Tree forests in All Forest Communities Group. This finch was chosen as a focal species primarily to represent the risk of grazing that other species in this group share with Cassin's finch. In addition, in contrast to pileated woodpecker and American marten, also focal species for larger trees, this species is primarily associated with open-canopied forests. Source habitats for this species overlap with species in the Dry forest group as well. This species is distributed year-round across the planning area in all the forested communities.

Model Description

Source Habitat

Cassin's finches breed primarily in open, mature coniferous forests of lodgepole and ponderosa pine, aspen, subalpine fir, grand fir, and juniper woodlands (Gaines 2007, Gashwiler 1977, Sullivan et al. 1986, Huff and Brown 1998, Reinkensmeyer 2000, Schwab et al. 2006). In the Blue Mountains, these finches were negatively associated with habitat variables representing increasing crown cover and down woody debris, and were positively associated with canopy height (Sallabanks 1995).

On both the Fremont and Winema national forests, these finches were more abundant in salvage-logged stands where dead and down lodgepole pine were removed than in unharvested control stands (Arnett et al. 1997, 2001). This research also found that the probability of presence of Cassin's finches was negatively associated with the number of live and dead trees, number of live trees <32.8 ft (<10m) tall, percentage of seedling cover, percentage of shrub and grass forb cover, foliage area of live trees, and percentage of canopy cover. The probability of presence of Cassin's finches was positively associated with number of trees >11.8 in (>30 cm) dbh and the amount of ground debris (Arnett et al. 1997, 2001). The presence of Cassin's finches was negatively associated with understory vegetation (Hutto 1995). Reinkensmeyer (2000) found Cassin's finches three times more abundant in old-growth juniper with a sparse shrub layer than mid-successional juniper with an intact shrub layer. The more open structure was preferred for nesting and allowed them to forage on ground (Bettinger 2003).

Hutto (1995) found Cassin's finches abundant 1 yr post-fire in the Rocky Mountains, though their numbers dropped off in the second year following fire. This species occupies burned forests as well though this is usually restricted to 1 year post-fire (Hutto 1995, Smucker et al. 2005) suggesting that this species may be responding to short-term increases in the availability of seeds after wildfire (Jewett et al. 1953, Hutto 1995, Kotliar et al. 2002, Saab and Dudley 1998, Sallabanks 1995, Smucker et al. 2005).

We identified source habitat as:

- Potential vegetation types: xp,dp,dd,dg,cm,cd
- Tree size: >=40 cm (15" dbh)
- Canopy closure: <=60 (cd,cm); <=40 dg,dd,dp,xp)

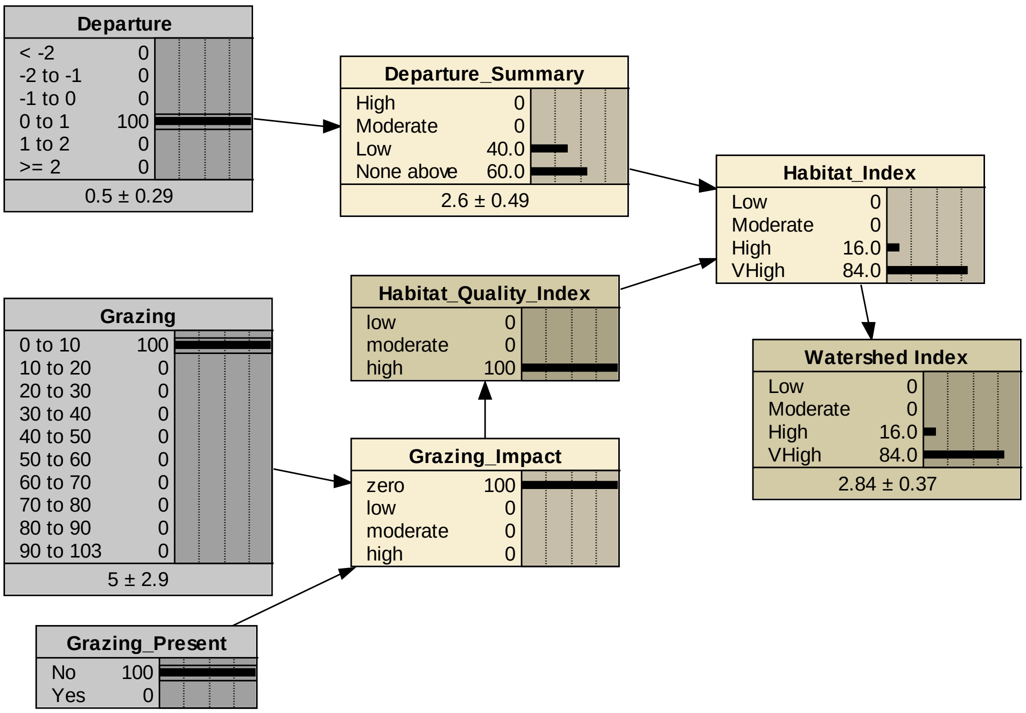
Grazing

Saab et al. (1995) summarized the results of 5 studies that evaluated the effects of livestock grazing on Cassin's finch. Three of the five studies found that Cassin's finchs responded negatively to grazing (i.e. Page et al. 1978, Taylor 1986, Schulz and Leininger 1991), one found a neutral effect (i.e. Medin and Clary 1991) and one found a positive relationship (i.e. Mosconi and Hutto 1982). The amount of potential habitat in an active grazing allotment was categorized using 10% increments from 0-100%, with increasing poorer habitat outcomes as the proportion of potential habitat in an active allotment increased. We calibrated the overall negative effect of this risk factor to be relatively small due to the mixed results in the research results.

Historical Inputs for Focal Species Assessment Model

Departure of source habitat from departure class - Class 1
Grazing – 0%

Cassin's Finch Focal Species Assessment Model



Figure—Focal species assessment model for Cassin's finch

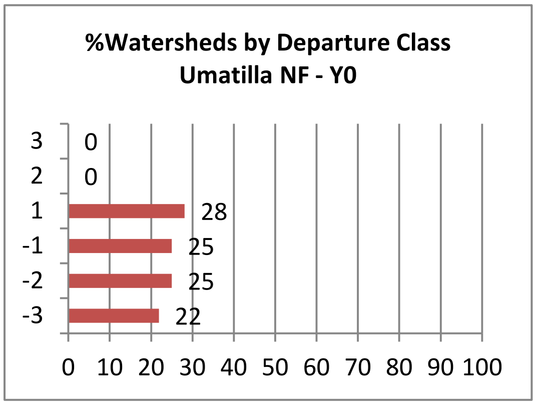
Table - Relative sensitivity of watershed index values to variables in the model for Cassin's finch

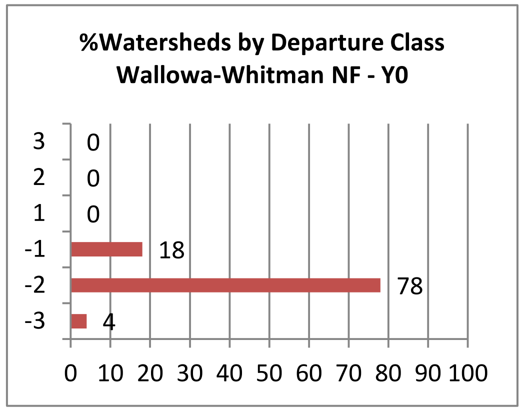
Variable	Sensitivity rank
Habitat departure	1
Grazing	2

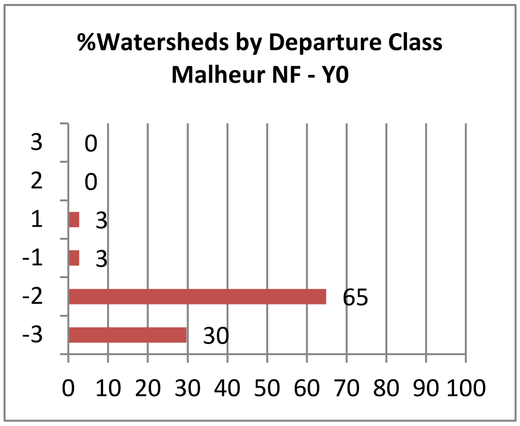
Assessment Results

Watershed Index Scores

Habitat for Cassin's finches was estimated to be well below the historical median amount of source habitat (class -3 or -2) in the majority of watersheds on all 3 National Forests.







Although the area of potential habitat in an active grazing allotment was high with >50% of the watersheds having the majority of area in an active allotment, as stated earlier, this risk factor was not weighted heavily in the watershed index model. Overall, the extensive departure in the amount of source habitat from the historical amount in nearly all the watersheds led to fairly low watershed index values for the current time period.

		% Grazing*	
	# Watersheds	0-50%	>=50%
UMA	32	28% (n=9)	72% (n=23)
WAW	50	46% (n=23)	54% (n=27)
MAL	37	5% (n=2)	95% (n=35)

Viability Outcome

Currently, primarily the high amount of habitat departure is leading to a low viability outcome currently. The Weighted Watershed Index (WWI) provides a relative measure across watersheds of the potential capability of the watershed to contribute to the viability of the focal species. The current WWI on the Umatilla NF was the highest (34%) due to fewer watersheds well below the median RV, while the Wallowa-Whitman NF and the Malheur NF are at <20% of Historical WWI. The distribution of habitats across the planning areas was greatest on the Malheur NF. The viability outcome on the Umatilla NF is the highest with primarily a C/D outcome, and primarily a D outcome on the other 2 Forests.

Viability Outcome	Umatilla NF		Wallowa-Whitman NF		Malheur NF	
	Historical	Current	Historical	Current	Historical	Current
HisWWI/CurWWI	100	35.3	100	16.2	100	17
%Hucs >=40%	69	34	74	34	78	54
Clusters	3/3	3/3	4/4	3/4 high	3/3	3/3
A	75	0	80	0	80	0
B	18	0	14	0	14	0
C	6	46	5	3	5	7
D	1	44	1	55	1	67
E	0	10	0	42	0	26

Alternative B Viability Analysis

We evaluated the viability for Cassin’s finch for Alternative B in 2 time periods (year 20, and year 50) using the outputs of vegetation modeling. We assumed the one risk factor, grazing to remain the same through all time periods.

At year 20, the amount of habitat on the Umatilla NF, actually declines (largely due to a large loss of habitat in the Wenaha watershed), but through year 50, the habitat is showing an increasing trend. Although habitat decreases overall at year 50, some watersheds have increasing trends that they increase above the 40% cut-off, thus increasing the overall distribution of habitat across the planning area.

Viability Outcome	Umatilla NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		246,673	214,222	237,093
A	75	0	0	0
B	18	0	0	0
C	6	46	62	62
D	1	44	38	38
E	0	10	0	0

Viability Outcome	Wallowa-Whitman NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		199,699	217,716	268,725
A	80	0	0	0
B	14	0	0	0
C	5	3	6	62
D	1	55	66	38
E	0	42	28	0

Viability Outcome	Malheur NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		324,599	433,307	423,495
A	80	0	0	0
B	14	0	0	0
C	5	7	65	64
D	1	67	35	36
E	0	26	0	0

In Summary:

Although overall the amount of source habitat is increasing, generally viability will remain low across the Blue Mountains. The Malheur NF shows the greatest increase in the amount of habitat and thus the viability outcome increases. The Malheur NF has plan objectives to increase habitat for Cassin's finch. Additionally plan objectives to increase habitat for white-headed woodpeckers on all 3 Forests should also benefit Cassin's finch as their source habitats overlap. Plan components of Alt. B (see table below) provide for conservation of large trees and old forest. These plan components along with others described in the desired conditions of this alternative should help to benefit or maintain habitat conditions for Cassin's finch.

WLD-HAB-2 G-2	**Guideline** Areal extent of existing late old structure stands within the moist and cold old forest types that are 300 acres or larger should not be reduced or fragmented.
OF-1 G-59	**Guideline** Management activities in old forest stands should retain live old forest trees (≥ 21 inches DBH). Exceptions include: • old forest tree(s) need to be removed to favor hardwood species, such as aspen or cottonwood, or other special habitats • old forest late seral species, such as grand fir, are competing with large diameter early seral species, such as ponderosa pine • old forest tree(s) need to be removed to reduce danger/hazard trees along roads and in developed sites • a limited amount of old forest trees need to be removed where strategically critical to reinforce and improve effectiveness of fuel reduction in WUIs
OF-2 G-60	**Guideline** Management activities in non-old forest stands should retain live legacy old forest trees (≥ 21 inches DBH). Exceptions to retaining live legacy old forest trees are the same as those noted in the previous guideline (OF-1).

References:

Arnett, E. B., B. Altman, and W. P. Erickson. 1997. Relationships between salvage logging and forest avifauna in lodgepole pine forests of the central Oregon pumice zone. Unpubl. Annual rep., Winema and Fremont National Forests.

Arnett, E. B., B. Altman, W. P. Erickson, and K. A. Bettinger. 2001. Relationships between salvage logging and forest avifauna in lodgepole pine forests of the central Oregon pumice zone. Unpubl. Final rep., Weyerhauser Co., Federal Way, WA.

Bettinger, K. A. 2003. Cassin's Finch. PP. 599-601 in Birds of Oregon: A General Reference. D. B. Marshall, M. G. Hunter, and A. L. Contreras, Eds. Oregon State University Press, Corvallis, OR.

Gaines, W. L. , M. Haggard , J. F. Lehmkuhl , A. L. Lyons , and R. J. Harrod . 2007. Short-term responses of land birds to ponderosa pine restoration. Restoration Ecology 15(4) pp. 670-678.

Gashwiler, J.S. 1977. Bird populations in four vegetational types in central Oregon. U.S. Fish and Wildl. Serv. Spec. Sci. Rep. –Wildl. 205.

Hahn, T. P. 1996. Cassin's Finch (*Carpodacus cassinii*). In The Birds of North America, No. 240 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American, Ornithologist's Union, Washington, D.C.

Huff, M. and M. Brown. 1998. Four years of bird point count monitoring in late-successional conifer forests and riparian areas from the Pacific Northwest National Forests, interim results. U.S. For. Serv., Portland.

Hutto, R. L. 1995. Composition of bird communities following stand-replacement fires in northern Rocky Mountain U.S. A. conifer forests. Cons. Biol. 9:1041-1058.

Jewett, S. G., W.P. Taylor, W.T. Shaw, and J. W. Aldrich. 1953. Birds of Washington State. Univ. of Wash. Press, Seattle.

Kotliar, N.B, Hejl, S.J., Hutto, R.L., Saab, V.A., Melcher, C.P., McFadzen, M.E. 2002. Effects of fire and post-fire salvage logging on avian communities in conifer-dominated forests of the western United States. Studies in Avian Biol. 25: 49-64.

Medin, D.E., and W. P. Clary. 1991. Breeding bird populations in a grazed and ungrazed riparian habitat in Nevada. USDA Forest Serv. Intermt. Res. Sta. Res. Pap. INT-441.

Mosconi, D. L., and R. L. Hutto. 1982. The effects of grazing on land birds of a western Montana riparian habitat. Pp. 221-223 in Wildlife-livestock relationships symposium (J.M. Peek and P.D. Dalke. Eds). University of Idaho, Forest Wildl. Range Exp. Sta. Moscow, ID.

Page, J. L., N. Dodd, T. O. Osborne, and J. A. Carson 1978. The influence of livestock grazing on non-game wildlife. Cal. Nev. Wildl. 1978:159-173.

Reinkensmeyer, D. P. 2000. Habitat associations of bird communities in shrub-steppe and western juniper woodlands. M.S. Thesis, Oreg. State Univ. Corvallis.

Saab, Victoria, and Jonathan Dudley. 1998. Responses of cavity-nesting birds to stand-replacement fire and salvage logging in ponderosa pine/Douglas-fir forests of southwestern Idaho. USDA Forest Service, Rocky Mtn. Res. Sta., Ogden, UT. Res. Paper RMRS-RP-11. 17 p.

Saab, V. A., C. E. Bock, T.D.G. Rich, and D.S. Dobkin. 1995. Livestock grazing effects in western North America. Pp. 311-353 in T. E. Martin and D. M. Finch (editors). Ecology and management of neotropical migratory birds: a synthesis and review of critical issues. Oxford University Press, New York, NY.

Sallabanks, R. 1995. Avian biodiversity and bird-habitat relationships in conifer forest of the inland northwest: an ecosystem management approach. Annual rep. to Boise Cascade Corp., natl. Fish and Wildl. Found., Natl. Counc. For Air and Stream Improvement, and U.S. For. Serv. Sustainable Ecosystems Inst., Meridian, ID.

Schulz, T. T., and W. C. Leininger. 1991. Nongame wildlife communities in grazed and ungrazed montane riparian sites. Great Basin Natur. 51:286-292

Schwab, F.E., Simon, N.P., Sinclair, A.R. 2006. Bird- vegetation relationships in Southeastern British Columbia. Journal of Wildlife Management 70(1):189-197.

Smucker, K.M, R.L.Hutto, B.M. Steele. 2005. Changes in bird abundance after wildfire: importance of fire severity and time since fire. Ecological Applications: Vol. 15, No. 5, pp. 1535-1549.

Sullivan, S. L., W.H. Pyle, and S.G. Herman. 1986. Cassin's Finch nesting in big sagebrush. Condor 88: 378-379.

Taylor, D.M. 1986. Effects of cattle grazing on passerine bird nesting in riparian habitat. J. Range Manag. 39:254-258.

PILEATED WOODPECKER (*Dyrocopus pileatus*) MODEL APPLICATION AND ASSESSMENT OF RESULTS

Introduction

Pileated woodpecker (*Dyrocopus pileatus*) was chosen as a focal species to represent species of conservation concern associated with Medium-large trees/Cool/Moist forests Group. This species also prefers areas with high densities of large snags and logs for foraging, roosting and nesting as do many of the other species of in this Group and Family. This species is well distributed across the planning area year round.

Source Habitat Description

Pileated woodpeckers prefer late successional stages of coniferous or deciduous forest, but also use younger forests that have scattered, large, dead trees (Bull and Jackson 1995. Bull et al. 2007). In northeastern Oregon, pileated woodpeckers selected unlogged stands of old-growth grand fir (Abies grandis) with closed canopies (Bull and Holthausen 1993) and in some cases open stands with high densities of large snags and logs (Bull et al. 2007). These woodpeckers are rarely found in stands of pure ponderosa pine (Bull and Holthausen 1993). Will use Englemann spruce at high elevation if big trees are present (E. Bull personal communication). In western Oregon, densities are greater in forests >80 yr old than in younger ones (Nelson 1988). Their association with late seral stages stems from their use of large-diameter snags or living trees with decay for nest and roost sites, large-diameter trees and logs for foraging on ants and other arthropods, and a dense canopy to provide cover from predators (Bull 2003).

In the Coast Range, mature stands (>70 yr) were selected by pileated woodpeckers, and younger stands were avoided for foraging (Mellen 1987). Mannan (1984) reported 44% of the foraging occurred in dead trees, 36% on downed logs, and the remainder in other substrates. Results of foraging location were similar in northeastern Oregon (Bull and Holthausen, 1993).

Source habitat for this species is defined as:

- Potential vegetation: dry Douglas fir, dry grand fir, cool moist, cold dry

- Tree size - >=20” dbh
- Canopy closure: >=40% in dry Douglas fir, dry grand fir, >=60% in cool moist, cold dry
- Layers: single- and multi-story

Snag Density

Pileated woodpeckers nests cavities are quite large (mean diameter of 8 in (21 cm) and depth of 22 in (57 cm) and are excavated at an average height of 50 ft (15 m) above the ground, so nest trees mush have a girth large enough to contain nest cavities at this height (Bull 1987). Of 105 nest trees located in northeastern Oregon, 75% were in ponderosa pine, 25% in western larch and 2% in grand fir; mean dbh and height of trees was 33 in (84 cm) (Bull 1987).

In northeastern Oregon pileated woodpecker roosts were typically located in a live or dead grand fir with a mean dbh of 28 in (71 cm) (Bull et al. 1992). In the Coast range, Douglas-fir, red alder, western redcedar, and big-leaf maple contained roosts (Mellen 1987).

In northeast Oregon, 75% of nest trees were ponderosa pine (*Pinus Ponderosa*) and mean dbh of nest trees was 84 cm (Bull 1987). In western Oregon, 73% of nest trees were Douglas-fir (*Pseudosuga Menziesii*) and nest trees averaged 69 cm dbh (Mellen 1987). In northwest Montana, most of 54 nest trees were large western larch (*Larix Occidenatalis*) and nest trees averaged 74.9 cm dbh (McClelland 1979).

Timber harvest has had a negative effect on habitat for this woodpecker (Bull 2003, Bull et al. 2007). Removal of large-diameter live and dead trees, of down woody material, and of canopy eliminates nest and roost sites, foraging habitat, and protective cover. In addition, prescribed fire may eliminate or reduce the number of snags, logs, and cover (Bull 2003).

Using the GNN data (Ohmann and Gregory 2002), we calculated the percentage of source habitat within a watershed that had snag densities (>50 cm dbh) in the following classes (per hectare):

Low <1/ha
Moderate 1.1-6.0
High 6.0-18.1
Very High >18.1

These density classes were taken from Decaid, to correspond to the different tolerance levels of the eastside mixed conifer forest type (Mellen-McLean et al. 2009).

Road Density

We included a road density variable to account for likely reduced snag densities along roads. Bate et al. (2007) and Wisdom and Bate (2008), found that snag numbers were lower adjacent to roads due to removal for safety considerations, removal as firewood, and other management activities.

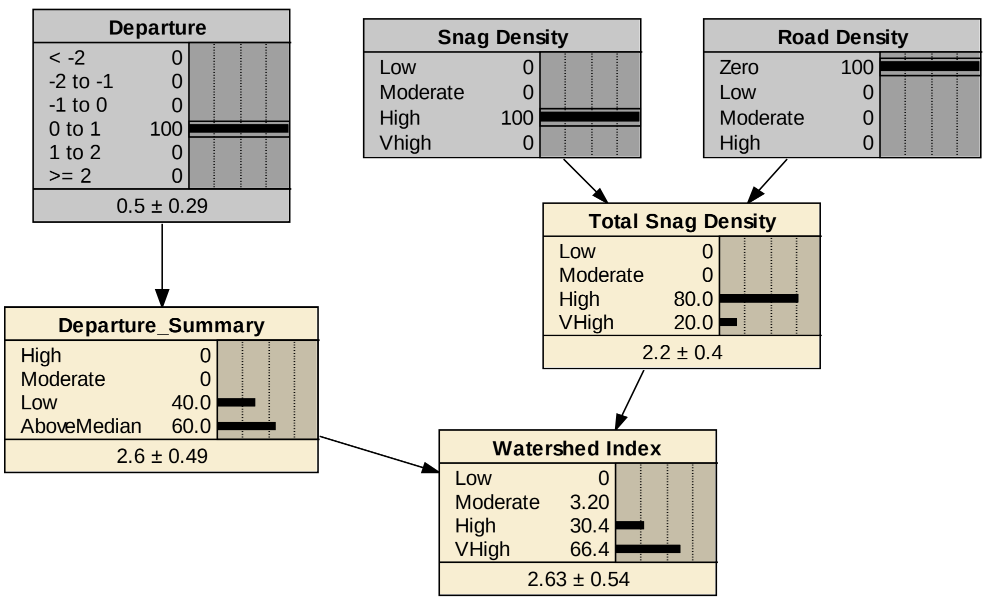
We calculated the percent of potential habitat in the following road density classes:

- Zero - <0.06 km/km2 open roads in watershed (<0.1 mi/mi2)
- Low - 0.06-0.62 km/km2 open roads in watershed (0.1-1.0 mi/mi2)
- Moderate - 0.63-1.24 km/km2 open roads in watershed (1.1-2.0 mi/mi2)
- High - >1.24 km/km2 open roads in watershed (>2.0 mi/mi2)

Historical Inputs for Focal Species Assessment Model

Habitat departure - Class 1
Snag Density - Low 30%; Moderate 20%, High 30%, and Very High 20%
Road Density – Zero

Pileated Woodpecker Watershed Index Model:



Figure—Focal species assessment model for pileated woodpecker

Table -- Relative sensitivity of Watershed Index values to variables in the model for pileated woodpecker

Variable	Sensitivity rank

Habitat departure	1
Snag density	2
Road density	3

Watershed Index Model Application

Habitat Influences

The abundance of closed-canopied forests with >20" dbh in the dd,dg, cm, and cd potential vegetation types has declined from the historical condition. Currently most of the watersheds on the Umatilla and Wallowa-Whitman NFs have less habitat than the historical median. On the Malheur NF the number of watersheds

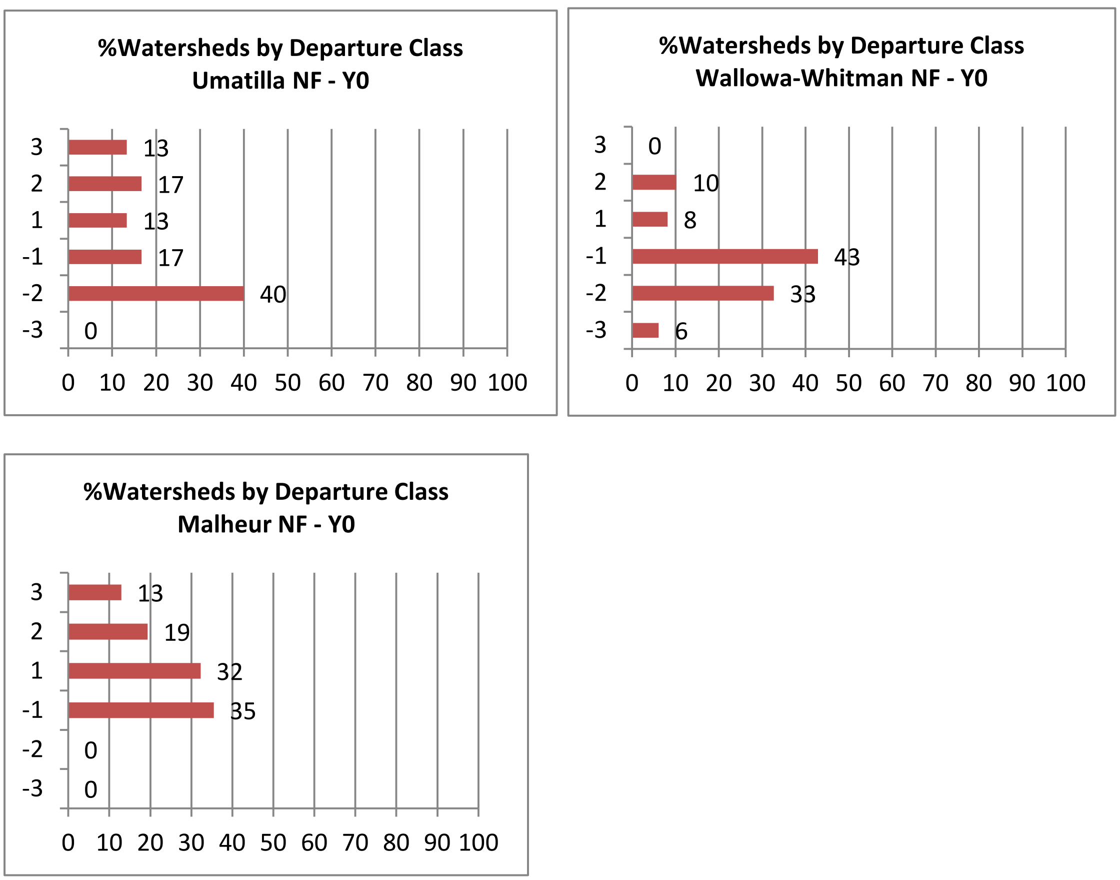


Figure: % of watersheds in the different habitat departure classes – Current conditions

The availability of snag habitat was an important habitat feature within source habitat for pileated woodpeckers (Bull et al. 1986, 1992, Raphael and White 1984). We assessed the density of large diameter snags (>50 cm) within source habitat for each watershed. Overall, snag densities were in the low or moderate category as most watersheds had >50% of the source habitat with <6.0 snags/ha (low or moderate). Historically we would have expected 50% of the habitat to be in the low or moderate categories, and 50% in the high and very-high categories.

Road densities were calculated to assess the effects roads have on snag densities. Road densities were variable, though primarily in the low or moderate category.

		Snag densities*		Road densities**	
	# Watersheds	Low and Moderate)	High and Very High	Zero and Low	Moderate and High
UMA	30	57% (n=17)	43% (n=13)	70% (n=23)	30% (n=8)
WAW	49	90% (n=44)	10% (n=5)	57% (n=28)	43% (n=21)
MAL	31	90% (n=26)	10% (n=3)	16% (n=5)	84% (n=26)
Blue Mthns	105	81% (n=85)	19% (n=20)	49% (n=51)	51% (n=54)

Table: Existing condition Snag and Road densities by forest.

*snag densities- % of watersheds with >=50% of the source habitat in the different snag classes

**road densities - % of watersheds with >50% of potential habitat in the different road density classes

Viability Outcome Scores

Viability Outcome	Umatilla NF		Wallowa-Whitman NF		Malheur NF	
	Historical	Current	Historical	Current	Historical	Current
HisWWI/CurWWI	100	78	100	48	100	92
%Hucs >=40%	70	63	71	59	81	74
Clusters	3/3	3/3	4/4	4/4	3/3	3/3
A	80	30	80	0	85	76
B	14	55	14	22	11	16
C	5	10	5	72	4	7
D	1	5	1	6	1	1
E	0	0	0	0	0	0

Figure VO—Viability outcome Historical and Current (Y0)

In summary, under historical conditions, pileated woodpeckers were likely well-distributed throughout the planning areas. Currently on the Malheur and Umatilla NFs though habitat abundance has declined in some watersheds, habitat has increased above the historical median in others leading to little change in the overall viability outcome. On the Wallowa-Whitman NF, the viability outcome currently is primarily a C. It is likely that other species in the Medium-large trees/Cool/Moist forest Group may have experienced similar declines on the Wallowa-Whitman NF as did the pileated woodpecker.

Alternative B viability analysis:

We evaluated the viability for the pileated woodpecker for Alternative B in 2 time periods (year 20, and year 50) using the outputs of vegetation modeling. We assumed snag densities increased at the same rate as the change in modeled source habitat (e.g. if habitat increased 10%, snag densities in the 'high' category increased 10%). We assumed no change in the road density attribute.

The projected viability outcomes for Alternative B show overall little change in viability at Year 20 on all three planning areas. A decrease in projected outcomes at Year 50 is primarily due to a projected loss in source habitat. There is a projected loss in source habitat through year 50 on all three NFs though total habitat abundance remains within the RV.

There are several plan components that protect source habitat, and address the risk factors associated with this species. There are desired conditions for snag densities to be retained at RV levels, and several standards and guidelines that address conservation of larger trees, and limits to road construction. The following table shows some of the plan components of Alternative B that should benefit pileated woodpecker habitat:

WLD-HAB-2 G-2	**Guideline** Areal extent of existing late old structure stands within the moist and cold old forest types that are 300 acres or larger should not be reduced or fragmented.
WLD-HAB-11 G-11	**Guideline** To the extent practical, known cavity or nest trees should be preserved when conducting prescribed burning activities, mechanical fuel treatments, and silvicultural treatments.
WLD-HAB-13 S-7	**Standard** Where management activities occur within dry or cool moist forest habitat, all snags 21 inches DBH and greater and 50 percent of the snags from 12 to 21 inches DBH shall be retained, except for the removal of danger/hazard trees. Snags shall be retained in patches.
OF-1 G-59	**Guideline** Management activities in old forest stands should retain live old forest trees (≥ 21 inches DBH). Exceptions include: • old forest tree(s) need to be removed to favor hardwood species, such as aspen or cottonwood, or other special habitats • old forest late seral species, such as grand fir, are competing with large diameter early seral species, such as ponderosa pine • old forest tree(s) need to be removed to reduce danger/hazard trees along roads and in developed sites • a limited amount of old forest trees need to be removed where strategically critical to reinforce and improve effectiveness of fuel reduction in WUIs

OF-2 G-60	**Guideline** Management activities in non-old forest stands should retain live legacy old forest trees (≥ 21 inches DBH). Exceptions to retaining live legacy old forest trees are the same as those noted in the previous guideline (OF-1).
OF-3	**Guideline** New motor vehicle routes should not be constructed within old forest stands.

In Summary, the viability outcome likely stays about the same through year 20 on all 3 planning areas. Declines in habitat through year 50 may lead to reduced viability outcomes at year 50. Plan components of Alt. B provide for conservation of large trees, old forest, and protection of road construction in some areas. These plan components should help to benefit or maintain habitat conditions for pileated woodpeckers.

Viability Outcome	Umatilla NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		213,445	235,920	202,162
A	80	30	71	30
B	14	55	19	55
C	5	10	9	19
D	1	5	1	5
E	0	0	0	0

Viability Outcome	Wallowa-Whitman NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		206,175	202,785	163,669
A	80	0	0	0
B	14	22	23	0
C	5	72	73	64
D	1	6	5	36
E	0	0	0	0

Viability Outcome	Malheur NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		186,761	179,132	160,225
A	85	76	76	32
B	11	16	16	56
C	4	7	7	8

D	1	1	1	4
E	0	0	0	0

References:

Bate, L. J., Wisdom, M. J., Wales, B. C. 2007. Snag densities in relation to human access and associated management factors in forests of Northeastern Oregon, USA. Landscape and Urban Planning 80. pp 278-291.

Bonar, R.L. 1999. Availability of pileated woodpecker cavities and use by other species. J. Wildl. Manage. 64(1):52-59.

Bull, Evelyn L.1987. Ecology of the pileated woodpecker in northeastern Oregon. Journal of Wildlife Management 51 (2):472-481.

Bull, E.L. 2003. Pileated Woodpecker. Pp. 372-374 *in* Birds of Oregon: A General Reference. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, OR.

Bull, E.L., and J.E. Jackson. 1995. Pileated Woodpecer (*Dryocopus pileatus*). *In* The Birds of North America, No. 148 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

Bull, E.L., and R. S. Holthausen. 1993. Habitat use and management of Pileated Woodpeckers in northeastern Oregon. J. Wildl. Manage. 57: 335-345.

Bull, E.L., M. Snider. 1993. Master carpenter. Wildbird 7(2):41-43.

Bull, E.L., R.S. Holthausen, and M. G. Henjum. 1992. Roost trees used by Pileated Woodpeckers in northeastern Oregon. J. Wildl. Manage. 56: 786-793.

Bull, Evelyn L.; Clark, Abe A.; Shepherd, Jay F. 2005. Short-term effects of fuel reduction on pileated woodpeckers in northeastern Oregon—a pilot study. Res. Pap. PNW-RP-564. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 17 p.

Bull, Evelyn, Nicole Nielsen-Pincus, Barbara C. Wales and Jane L. Hayes. 2007. The influence of disturbance events on pileated woodpeckers in northeastern Oregon. Forest Ecology and Management 243, 329-329.

Hoyt, S. F. 1957. The ecology of the pileated woodpecker. Ecology 38:246-56

Mannan, R. W. 1984. Summer area requirements of Pileated Woodpeckers in western Oregon. Wildl. Soc. Bull. 12: 265-268.

McClelland, B.R. 1977. Relationships between hole-nesting birds, forest snags, and decay in western larch-Douglas-fir forests of the northern Rocky Mountains. Dissertation University of Montana, Missoula, Montana, USA.

Mellen, T. K. 1987. Home range and habitat use by Pileated Woodpeckers. Master's thesis. Oregon State Univ., Corvallis.

Mellen-McLean, Kim, Bruce G. Marcot, Janet L. Ohmann, Karen Waddell, Susan A. Livingston, Elizabeth A. Willhite, Bruce B. Hostetler, Catherine Ogden, and Tina Dreisbach. 2009. DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 2.1. USDA Forest Service, Pacific Northwest Region and Pacific Northwest Research Station; USDI Fish and Wildlife Service, Oregon State Office; Portland, Oregon. http://www.fs.fed.us/r6/nr/wildlife/decaid/index.shtml

McClelland, B. R. 1979. The pileated woodpecker in forests of the northern Rocky Mountians. Pages 283-99 in J. G. Dickson, R. N. Conner, R. R. Fleet, J. A. Jackson And J. C. Kroll (editors). The Role of Insectivorous birds in forest Ecosystems. Academic Press, New York, New York.

Nelson, S. K. 1989. Habitat use and densities of cavity nesting birds in the Oregon Coast Ranges. Thesis, Oregon State University, Corvallis, Oregon, USA.

Ohmann, J. L., and M. J. Gregory. 2002. Predictive mapping of forest composition and structure with direct gradient analysis and nearest neighbor imputation in the coastal province of Oregon, USA. Canadian Journal of Forest Research 32:725-741.

Raphael, M.G., and M. White. 1984. Use of snags by cavity-nesting birds in the Sierra Nevada. Wildlife Monographs. 86:1-66.

Wisdom, M.J., R.S. Holthausen, B.C. Wales, [and others]. 2000. Source habitats for terrestrial vertebrates of focus in the Interior Columbia Basin: broad-scale trends and management implications. USDA Forest Service, PNW-GTR-485.

Wisdom, M. J. and L. J. Bate. 2008. Snag density varies with intensity of timber harvest and human access. Forest Ecology and Management 255:2085–2093.

AMERICAN MARTEN (*Martes americana*) MODEL APPLICATION AND ASSESSMENT OF RESULTS

Introduction

Significant declines in the distribution of endemic carnivore species have occurred across North America since the arrival of Europeans (Giblisco 1994, Laliberte and Ripple 2004) with major reductions in marten populations resulting from the fur trade and timber harvest (Giblisco 1994). Despite protection from trapping since 1953, continued habitat loss has led to increased concern about martens in the West (Ruggiero et al. 1994, Zielinski et al. 2001). American martens have a wide distribution across the western and eastern portions of the planning area (Johnson and Cassidy 1997) and large home ranges making them a good focal species to represent landscape characteristics of the Cool/Moist Forests Group in the Medium/Large Trees Family. Martens were associated with large trees, snags, and coarse woody debris all of which were affected by timber management practices. Martens also have risk factors associated with human disturbance and roads. American martens were year-round residents of the planning area (Clark et al. 1987); this assessment was for year-round habitats.

Model Description

Source Habitat

For the purpose of this analysis source habitat for both current and historical conditions was considered to be cold moist and cold dry forests with multi-stories, large-tree structure, >20" dbh, and closed canopies (i.e., >60%). This designation of source habitat was based on research reported in Koehler et al. (1975), Campbell (1979), Martin (1987), Buskirk et al. (1989), Bull and Heater (2000), Wilbert et al. (2000), Nams and Bourgeois (2004), Gosse et al. (2005), and Kirk and Zielinski (2009).

This source habitat under the conditions described above (i.e., forests without a history of timber harvest) was assumed to have high snag and coarse woody debris (CWD) densities. Marten habitat values associated with varying snag densities were documented in Martin and Barrett (1991), Gilbert et al. (1997), Payer and Harrison (1999), and Ruggiero et al. (1998). Martin and Barrett (1991) found 39 logs/ha within habitats used by martens. Woody structures used for resting were large, with mean dbh of 93.9 cm for live-trees, 94.9 cm for snags, and 88.2 cm maximum-diameter for logs with a mean density of CWD of 13.2/ha (Buskirk et al. 1989, Slauson and Zielinski 2009). The mean age of 24 of the woody resting structures was 339 years (range 131–666 years). Natal den sites were found to have 117 pieces of CWD/ha and maternal den site had 90 pieces of CWD/ha (Ruggiero et al. 1998). Gilbert et al. (1997) found 150 logs/ha at den and rest sites. Marten avoided plots with low densities of CWD, whereas, plots with high to very high densities were selected by martens (Spencer et al. 1983). Log densities of 20-50/ha were considered optimum (Martin 1987). Andruskiw et al. (2008) showed that the frequency of prey encounter, prey attack, and prey kill were higher in old uncut forests for American martens, despite the fact that small-mammal density was similar to that in younger logged forests. These differences in predation efficiency were linked to higher abundance of CWD, which seems to offer sensory cues to martens, thereby increasing the odds of hunting success.

Potential Vegetation: Cold Moist, Cold Dry

Size Class: >20" dbh

Canopy Closure: >60%

Layers: multi-storied

Patch Size

Snyder and Bissonette (1987) reported limited use by martens of patches < 15 ha. Patches used by resident martens were 18 times larger (median = 27 ha) than patches that were not used (median = 1.5 ha) and were closer to adjacent forest preserves (Chapin et al. 1998). Median size of largest forest patch in martens' home ranges was 150 ha for females and 247 ha for males (Chapin et al. 1998). Similarly, Slauson et al. (2007) reported a minimum patch size used by American martens of >81 ha with a mean patch size of 181 ha. Potvin et al. (2000) recommended that uncut forest patches be >100 ha to maximize core area and to minimize edge. Generally, more habitat, larger patch sizes, and larger areas of interior forest were important predictors of occurrence (Chapin et al. 1998; Hargis et al. 1999; Potvin et al. 2000, Kirk and Zielinski 2009). Based on those findings, the following classes were used to describe the mean patch size of source habitat within watersheds:

low – <15 ha mean patch size of source habitat within a watershed
moderate – 15-100 ha mean patch size of source habitat within a watershed
high – >100 ha mean patch size of source habitat within a watershed

Riparian Habitat

Martens prefer riparian habitats throughout their range (Martin 1987, Buskirk et al. 1989, Anthony et al. 2003, Baldwin and Bender 2008) and habitats near water (Bull et al. 2005). Fecske et al. (2002) characterized this relationship by distinguishing areas < and > 100 m from streams. The suitability of riparian habitat was evaluated in this analysis by determining what percentage of the total area within 100 m of streams (i.e., perennial, orders 3 – 8) was source habitat on a watershed basis and then placing watersheds in the following classes:

low – <25% of a watershed within 100 m buffers was source habitat
moderate – 25% – 50% of a watershed within 100 m buffers was source habitat
high – >50% of a watershed within 100 m buffers was source habitat

Percentage of Landscape Open

Percentage of the landscape in openings was a primary factor in determining the quality of American martens' habitat. Hargis and Bissonette (1997) and Hargis et al. (1999) reported very little use by martens in landscapes with 25% or greater in openings. Potvin et al. (2000) also reported that martens' home ranges contained less than 30 – 35% clearcut openings. Clearcuts supported 0 – 33% of population levels of martens in nearby uncut forest (Soutiere 1979, Snyder and Bissonette 1987, Thompson et al. 1989). Marten population reductions of 67% were reported following removal of 60% of timber (Soutiere 1979) and 90% with 90% timber removal (Thompson 1994). Chapin et al. (1998) reported that martens tolerated 20% (median value) of their home range in regenerating forest. More recently, Dumyahn et al. (2007) demonstrated that American martens did not establish home ranges unless ≥70% of an area was suitable habitat. Also, Broquet et al. (2006) found that the movement of American marten individuals and gene flow through logged landscapes did not follow a linear, shortest path movement. Rather, movement was along a path that was better estimated by a least-cost path that avoided openings. The following classes were developed from those findings and used to characterize watersheds:

low – 0.0-10.0% of a watershed in open condition
moderate – 10.1-30.0% of a watershed in open condition
high – >30% of a watershed in open condition

Vegetation types were considered "closed" for this analysis if they had a tree canopy (i.e., ≥10% tree cover in the overstory layer). "Open" vegetation classes were all vegetation types without a tree canopy.

Road Density

Hodgman et al. (1994) reported 90% of martens' mortality resulted from trapping on an area with a road density of 1.09 km/sq. km. Thompson (1994) also reported that trapping was the major source of mortality for martens. He also observed that predation and trapping mortality rates were higher in logged forests (with road development) than in uncut forests. Alexander and Waters (2000) observed avoidance by martens of areas within 50 m of roads. Roads also facilitate the removal of snags as fire wood and for safety considerations (Gaines et al. 2003, Bate et al. 2007, Wisdom and Bate 2008). The findings of Godbout and Ouellet (2008) indicate that increasing road density results in lower quality habitat for American martens. Webb and Boyce (2009) showed that increased disturbance, particularly road access and oil and gas well sites, negatively affected habitats of American martens and reduced trapper success. The following density classes were summarized within potential habitat by watershed:

zero – <0.06 km/km^2 open roads (<0.1 mi/mi^2)
low – 0.06-0.62 km/km^2 open roads (0.1-1.0 mi/mi^2)
moderate – 0.63-1.24 km/km^2 open roads (1.1-2.0 mi/mi^2)
high – >1.24 km/km^2 open roads (>2.0 mi/mi^2)

Calculation of Historical Conditions

Values of the model variables were set with the following values to estimate historical habitat conditions:
Departure of source habitat – Class 1
Patch size – 1 class increase from current condition
Riparian habitat – same as current condition
Percentage of landscape open – same as current condition
Road density – class zero

Watershed Index Model

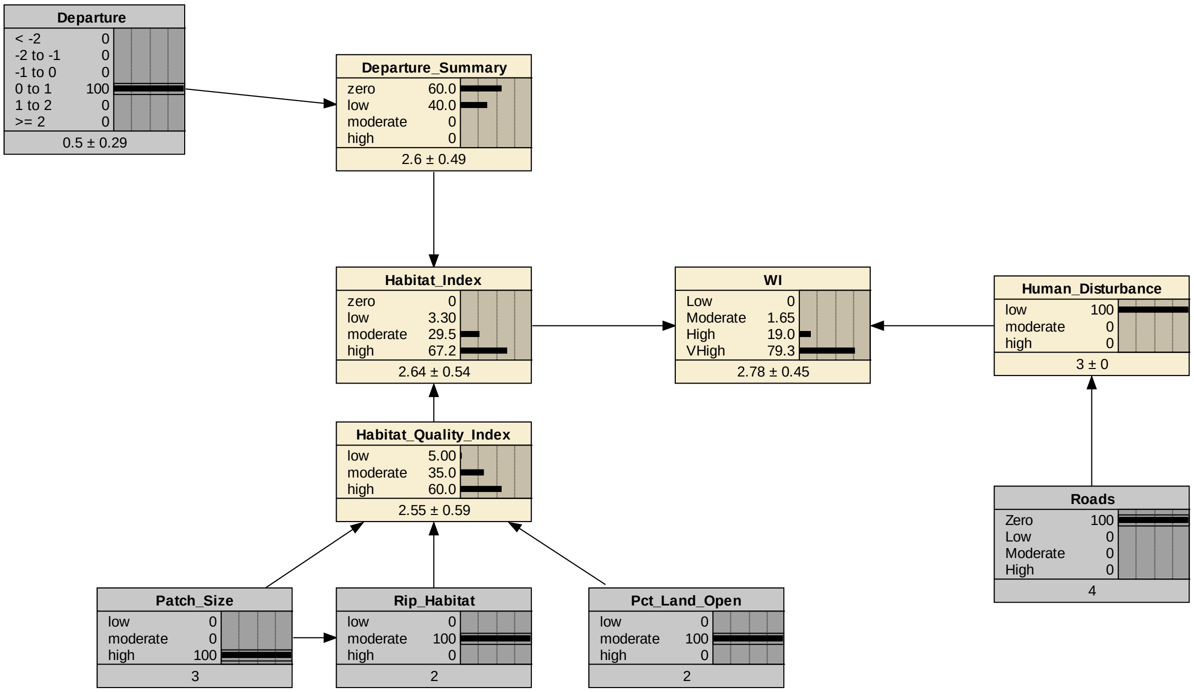


Figure —Focal species assessment model for American marten.

Table—Relative sensitivity of Watershed Index values to variables in the model for American marten.

Variable	Sensitivity rank
Habitat departure (amount)	1
Road density	2
Percentage of landscape open	3
Patch size	4
Riparian habitat	5

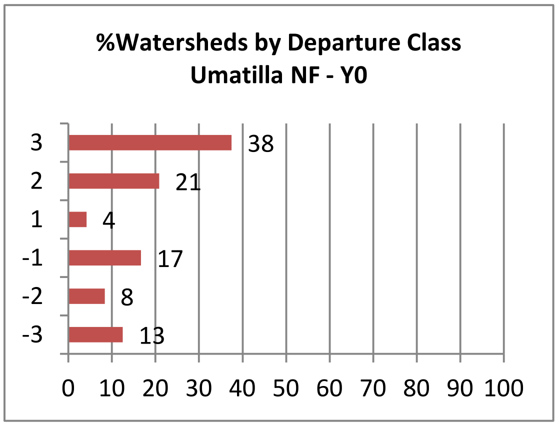
Assessment Results

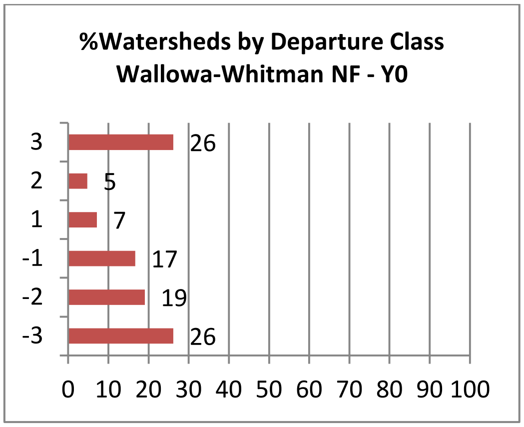
Watershed Index Scores

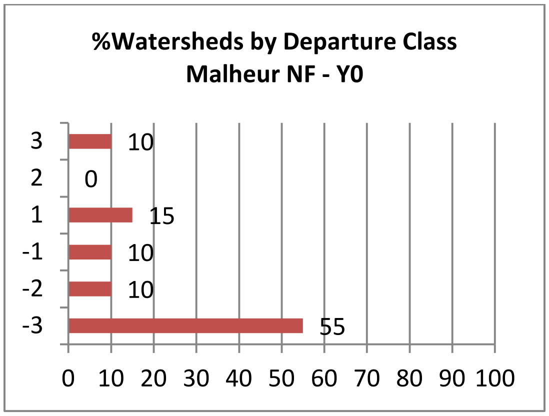
We included 82 watersheds that had >=500 ha of potential habitat in this analysis based on Bull and Heater (2001), who found home ranges in the Blue Mountains of Oregon to be well over 1000 ha for both males and females. Actual amounts of source habitat ranged from 10 ha to just over 10,000 ha in each watershed.

The watersheds with the greatest amounts of source habitats (>4,000 ha) are the Wenaha River, Eagle Creek, Pine Creek, Upper Catherine Creek, Upper Imnaha River, and the

Minam River. These watersheds are all well above the historic median of 16% of the potential, as they are all above 20% of the potential is currently source habitat. The Wenaha River has nearly twice the amount of source habitat (approximately 10,000 ha) as the Middle Wallowa which has the second highest amount of source habitat (approximately 5,000 ha).







		% Landscape Open			Patch Size			% Habitat in Riparian		
	# Water-sheds	High	Moderate	Low	Low	Moderate	High	Low	Moderate	High
UMA	24	21% (n=5)	38% (n=9)	42% (n=10)	4% (n=1)	92% (n=22)	4% (n=1)	75% (n=18)	25% (n=6)	0%
WAW	42	31% (n=13)	50% (n=21)	19% (n=8)	29% (n=12)	67% (n=28)	5% (n=2)	62% (n=26)	38% (n=16)	0%
MAL	20	10% (n=2)	35% (n=7)	44% (n=11)	75% (n=15)	25% (n=5)	0%	75% (n=15)	20% (n=4)	5% (n=1)
Blue Mtns	82	24% (n=20)	44% (n=36)	32% (n=26)	33% (n=27)	63% (n=52)	4% (n=3)	70% (n=57)	29% (n=24)	1% (n=1)

		Road Density	
	# Watersheds	Zero/Low	Moderate/High
UMA	24	79% (n=19)	21% (n=5)
WAW	42	57% (n=24)	43% (n=18)
MAL	20	30% (n=6)	70% (n=14)
Blue Mtns	82	56% (n=46)	44% (n=36)

Viability Outcome Scores

The viability outcome (VO) scores for marten varied across the 3 forests.

Marten viability on the Malheur NF, differed greatly from the other forests. Marten habitat historically was not abundant on this forest which led to a poorer viability projected historically as compared to the other forests. Loss of habitat is the primary cause of poorer viability on this forest currently. The loss of habitat has lead to poorer abundance and distribution overall.

Viability Outcome	Umatilla NF		Wallowa-Whitman NF		Malheur NF	
HisWWI/CurWWI	100	88	100	71	100	38
%Hucs >=40%	75	75	77	67	85	60
Clusters	3/3	3/3	4/4	4/4	2/3	2/3
	Historical	Current	Historical	Current	Historical	Current
A	69	59	67	2	0	0
B	23	31	25	58	46	0
C	6	9	7	32	37	1
D	2	2	2	8	15	52
E	0	0	0	0	2	47

Permeability		% Low	% Moderate	% High
Current	UMA	24	52	23
	WAW	40	44	16
	MAL	25	70	5
	Blues	31	54	15
Historical	UMA	22	48	31
	WAW	37	38	25
	MAL	18	71	11
	Blues	27	51	22

In summary, under historical conditions there was a high probability that viable populations of American martens and all other species associated with the Cool/Moist Forests Group in the Medium/Large Trees Family were well distributed throughout the planning area. Overall, in the Blue Mountains the viability outcome was projected to be primarily an ‘A’ on the Umatilla NF, a B/C on the Wallowa-Whitman NF, and a D/E on the Malheur NF.

The effects of development and habitat change especially on the Malheur NF has led to a lower probability that populations of American martens and all other species associated with the Cool/Moist Forests Group in the Medium/Large Trees Family are currently well-distributed in only a portion of the planning area.

Alternative B Viability Analysis

We evaluated the viability for Marten for Alternative B in 2 time periods (year 20, and year 50) using the outputs of vegetation modeling. We assumed road densities, percent of the landscape in open condition and amount of source habitat in riparian areas remained the same through all time periods. We assumed patch size patch size one class lower or one higher IF departure from previous time period changed 2 departure classes.

There is an increasing trend in the amount of habitat on the Umatilla and Malheur NF. The increasing trend in habitat on the Malheur NF leads to an increase in the viability outcome from the current D/E to a C in year 20. Habitat on the Malheur NF continues to increase through 50 years.

On the Umatilla NF, where overall habitat abundance continues to increase above the historical median, viability remains high at year 20, after which habitat abundance shows a decline at year 50 yet most watersheds are still within the RV for marten.

The exception is the Wallowa-Whitman NF where the habitat slightly declines, but viability remains the same at year 20. After 50 years however, there is a continued decline in the amount of source habitat on the Wallowa-Whitman NF which leads to lower viability outcomes.

Viability Outcome	Umatilla NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		113,933	137,888	125,597
A	69	59	68	55
B	23	31	24	32
C	6	9	6	11
D	2	2	2	3
E	0	0	0	0

Viability Outcome	Wallowa-Whitman NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		129,582	116,347	87,302
A	67	2	2	0
B	25	58	58	7
C	7	32	32	60
D	2	8	8	33
E	0	0	0	1

Viability Outcome	Malheur NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		25,787	31,637	35,028
A	0	0	0	0
B	46	0	8	8
C	37	1	60	60
D	15	52	32	32

E	2	47	0	0

The risk factors associated with this species are amount of source habitat in riparian areas, percent of the landscape in open condition, patch size and road densities.

Several plan components address the limited potential to harvest large trees especially in riparian areas (Guidelines 59,60 see table below). There is little indication from this alternative that extensive road building will occur. Several plan components stress the need to reduce road densities or have no net increase in road densities especially in key watersheds (Standard KW-1 (S-15)). These plan components should help to benefit or maintain habitat conditions for martens.

WLD-HAB-1 G-1	**Guideline** Management activities that limit the ability of wildlife to disperse between patches of source habitat should be avoided; area and patch size of late old structure should be maintained or improved and road density within and between old forest patches should be maintained or reduced.
WLD-HAB-2 G-2	**Guideline** Areal extent of existing late old structure stands within the moist and cold old forest types that are 300 acres or larger should not be reduced or fragmented.
WLD-HAB-3 G-3	**Guideline** Riparian corridors connecting moist and cold old forest types should not be reduced.
OF-1 G-59	**Guideline** Management activities in old forest stands should retain live old forest trees (≥ 21 inches DBH). Exceptions include: • old forest tree(s) need to be removed to favor hardwood species, such as aspen or cottonwood, or other special habitats • old forest late seral species, such as grand fir, are competing with large diameter early seral species, such as ponderosa pine • old forest tree(s) need to be removed to reduce danger/hazard trees along roads and in developed sites • a limited amount of old forest trees need to be removed where strategically critical to reinforce and improve effectiveness of fuel reduction in WUIs
OF-2 G-60	**Guideline** Management activities in non-old forest stands should retain live legacy old forest trees (≥ 21 inches DBH). Exceptions to retaining live legacy old forest trees are the same as those noted in the previous guideline (OF-1).
KW-1 S-15	**Standard** There shall be no net increase in the mileage of Forest Roads in any key watershed unless the increase results in a reduction in road-related risk to watershed condition. Priority should be given to roads that pose the greatest relative ecological risks to riparian and aquatic ecosystems.
OF-3 *New*	**Guideline** New motor vehicle routes should not be constructed within old forest stands.
WLD-HAB-28 G-14	**Guideline** Roads and trails should not be constructed within high elevation riparian areas.

In summary, on the Umatilla and Malheur NF's viability for martens should be increasing through year 20 due to plan components that encourage improving trends in habitat abundance and habitat quality. On the Wallowa-Whitman NF, though these same plan components are described, as modeled, habitat trends are decreasing and the viability outcome declines to likely a C, in year 50.

LITERATURE CITED

Alexander, S. M., and N. M. Waters. 2000. Modelling wildlife movement requisites in the Banff-Bow Valley transportation corridor. International Conference on Integrating GIS and Environmental Modeling (GIS/EM4) 4 (available at: http://www.colorado.edu/research/cires/banff/pubpapers/24/)

Andruskiw, M, J. M. Fryxell, I. D.Thompson, and J. A. Baker. 2008. Habitat-mediated variation in predation risk by the American marten. Ecology 89:2273–2280.

Anthony, R. G., W. A. O’Connell, M. M. Pollock, and J. G. Hallett. 2003. Association of mammals with riparian ecosystems in Pacific Northwest forests. Pages 510-563 *in* C. J. Zabel and R. G. Anthony, editors. Mammal community dynamics: management and conservation in the coniferous forests of North America. Cambridge University Press, New York, New York, USA.

Baldwin, R. A., and L. C. Bender. 2008. Distribution, occupancy, and habitat correlates of American martens (Martes americana) in Rocky Mountain National Park, Colorado. Journal of Mammalogy 89:419–427.

Bate, L. J., M. J. Wisdom, and B. C. Wales. 2007. Snag densities in relation to human access and associated management factors in forests of northeastern Oregon, USA. Landscape and Urban Planning 80:278–291.

Bull, E. L., and T. W. Heater. 2000. Resting and denning sites of American martens in northeastern Oregon. Northwest Science 74:179-185.

Bull, E. L., T. W. Heater, and J. F. Shepard. 2005. Habitat selection by the American marten in northeastern Oregon. Northwest Science 79:37-43.

Broquet, T., N. Ray, E. Petit, J. M. Fryxell, and F. Burel. 2006. Genetic isolation by distance and landscape connectivity in the American marten (Martes americana). Landscape Ecology 21:877–889.

Buskirk, S. W., S. C. Forrest, M. G. Raphael, and H. J. Harlow. 1989. Winter resting site ecology of marten in the central Rocky Mountains. Journal of Wildlife Management 53:191–196.

Campbell, T. M., III. 1979. Short-term effects of timber harvests on pine marten ecology. Thesis, Colorado State University, Fort Collins, Colorado, USA.

Chapin, T. G., D. J. Harrison, and D. D. Katnik. 1998. Influence of landscape pattern on habitat use by American marten in an industrial forest. Conservation Biology 12:1327-1337.

Clark, T. W., E. Anderson, C. Douglas, and M. Strickland. 1987. Martes americana. American Society of Mammalogists Mammalian Species 289.

Dumyahn, J. B., P. A. Zollner, and J. H. Gilbert. 2007. Winter home-range characteristics of American marten in northern Wisconsin. American Midland Naturalist 158:382–394.

Fecske, D. M., J. A. Jenks, and V. J. Smith. 2002. Field evaluation of a habitat-relation model for the American marten. Wildlife Society Bulletin 30:775-782.

Gaines, W. L., P. H. Singleton, and R. C. Ross. 2003. Assessing the cumulative effects of linear recreation routes on wildlife habitats on the Okanogan and Wenatchee National Forests. USDA Forest Service General Technical Report PNW-GTR-586.

Giblisco, C. J. 1994. Distributional dynamics of modern Martes in North America. Pages 59–70 in S. W. Buskirk, A. S. Harestad, M. G. Raphael, and R. A. Powell, eds. Martens, sables, and fishers: biology and conservation. Cornell University Press, Ithaca, New York, USA.

Gilbert, J. H., J. L. Wright, D. J. Lauten, and J. R. Probst. 1997. Den and rest-site characteristics of American marten and fisher in Northern Wisconsin. Pages 135-145 *in* G. Proulx, H. N. Bryant, and P. M. Woodard, editors. Martes: taxonomy, ecology, techniques, and management. Provincial Museum of Alberta, Edmonton, Alberta, Canada.

Godbout, G., and J. Ouellet. 2008 Habitat selection of American marten in a logged landscape at the southern fringe of the boreal forest. Ecoscience 15:332-342.

Gosse, J. W., R. Cox, S. W. Avery. 2005. Home-range characteristics and habitat use by American martens in eastern Newfoundland. Journal of Mammalogy 86:1156-1163.

Hargis, C. D., and J. A. Bissonette, and D. L. Turner. 1999. The influence of forest fragmentation and landscape pattern on American martens. Journal of Applied Ecology 36:157-172.

Hargis, C. D., and J. A. Bissonette. 1997. Effects of forest fragmentation on populations of American marten in the intermountain West. Pages 437-451 *in* G. Proulx, H. N. Bryant, and P. M. Woodard, editors. Martes: taxonomy, ecology, techniques, and management. Provincial Museum of Alberta, Edmonton, Alberta, Canada.

Hodgman, T. P., D. J. Harrison, D. D. Katnik, and K. D. Elowe. 1994. Survival in an intensively trapped marten population in Maine. Journal of Wildlife Management 58:593-600.

Johnson, R. E., and K. M. Cassidy. 1997. Terrestrial mammals of Washington State: location data and predicted distributions. Volume 3 in Washington Gap Analysis – Final Report. Washington Cooperative Fish and Wildlife Research Unit, University of Washington, Seattle, WA, USA.

Kirk, T. A., and W. J. Zielinski.. .2009. Developing and testing a landscape habitat suitability model for the American marten (Martes americana) in the Cascades mountains of California. Landscape Ecology 24:759-773.

Koehler, G. M., W. R. Moore, and R. A. Taylor. 1975. Preserving the pine marten: management guidelines for western forests. Western Wildlife 2:31-36.

Laliberte, A. S., and W. J. Ripple. 2004. Range contractions of North American carnivores and ungulates. Bioscience 54:123–138.

Martin, S. K. 1987. The ecology of the pine marten (*Martes americana*) at Sagehen Creek, California. Dissertation, University of California, Berkeley, California, USA.

Martin, S. K., and R. H. Barrett. 1991. Resting site selection by marten at Sagehen Creek, California. Northwest Naturalist 72:37–42.

Nams, V. O., and M. Bourgeois. 2004. Fractal dimension measures habitat use at different spatial scales: an example with marten. Canadian Journal of Zoology, 82:1738-1747.

Payer, R. D., and D. J. Harrison. 1999. Effects of forest structure on spatial distribution of American marten. National Council of the Paper Industry for Air and Stream Improvement Technical Bulletin 787.

Potvin, F., L. Belanger, and K. Lowell. 2000. Marten habitat selection in a clearcut boreal landscape. Conservation Biology 14:844-857.

Ruggiero, L. F., K. B. Aubry, S. W. Buskirk, L. J. Lyon, and W. J. Zielinski. 1994. The scientific basis for conserving forest carnivores: American marten, fisher, lynx and wolverine in the Western United States. USDA Forest Service General Technical Report GTR-RM-254.

Ruggiero, L. F., D. E. Pearson, and S. E. Henry. 1998. Characteristics of American marten den sites in Wyoming. Journal of Wildlife Management 62:663-673.

Slauson, K. M., and W. J. Zielinski. 2009. Characteristics of summer and fall diurnal resting habitat used by American martens in coastal northwestern California. Northwest Science 83:35-45.

Slauson, K. M., W. J. Zielinski, and J. P. Hayes. 2007. Habitat selection by American martens in coastal California. Journal of Wildlife Management 71:458–468.

Snyder, J. E., and J. A. Bissonette. 1987. Marten use of clear-cuttings and residual forest stands in western Newfoundland. Canadian Journal of Zoology 65:169-174.

Soutiere, E. C. 1979. Effects of timber harvesting on marten in Maine. Journal of Wildlife Management 43:850-860.

Spencer, W. D., R. H. Barrett, and W. J. Zielinski. 1983. Marten habitat preferences in the northern Sierra Nevada. Journal of Wildlife Management 47:1181-1186.

Thompson, I. D. 1994. Marten populations in uncut and logged boreal forests in Ontario. Journal of Wildlife Management 58:272–280.

Thompson, I. D., I. J. Davidson, S. O'Donnell, and F. Brazeau. 1989. Use of track transects to measure the relative occurrence of some boreal mammals in uncut forest and regeneration stands. Canadian Journal of Zoology 67:1816–1823.

Webb, S. M., and M. S. Boyce. 2009. Marten fur harvests and landscape change in west-central Alberta. Journal of Wildlife Management 73:894-903.

Wilbert, C. J., S. W. Buskirk, and K. G. Gerow. 2000. Effects of weather and snow on habitat selection by American martens. Canadian Journal of Zoology 78:1691-1696.

Wisdom, M. J., R. S. Holthausen, B. C. Wales, C. D. Hargis, V. A. Saab, D. C. Lee, W. J. Hann, T. D. Rich, M. M. Rowland, W. J. Murphy, and M. R. Eames. 2000. Source habitats for terrestrial vertebrates of focus in the interior Columbia basin: broad-scale trends and management implications. U.S. Forest Service Pacific Northwest Research Station PNW-GTR-485.

Wisdom, M. J. and L. J. Bate. 2008. Snag density varies with intensity of timber harvest and human access. Forest Ecology and Management 255:2085–2093.

Zielinski, W. J., K. M. Slauson, C. Carroll, C. Kent, and D. Kudrna. 2001. Status of American martens in coastal forests of the Pacific states. Journal of Mammalogy 82:478–490.

WHITE-HEADED WOODPECKER (Picoides albolarvatus) MODEL APPLICATION AND ASSESSMENT RESULTS

Introduction

White-headed Woodpecker (Picoides albolarvatus) was chosen as a focal species to represent the Medium-large trees/Dry forest group. The woodpecker is associated with open-canopied ponderosa pine forests and specifically with large trees and snags which are important habitat components for other species in the group and family. White-headed woodpeckers range across the entire Pacific Northwest in dry forests east of the Cascade Mountains of Oregon and Washington and are year-round residents (Garrett et al. 1996, Marshall 1997).

Source Habitat Description

White-headed woodpeckers occur in open ponderosa pine or mixed-conifer forests dominated by ponderosa pine (Bull et al. 1986, Dixon 1995a, 1995b, Frenzel 2000). Dixon (1995a, 1995b) found population density increased with increasing volumes of old-growth ponderosa pine in both contiguous and fragmented sites. In addition, these woodpeckers may use areas which have undergone various silvicultural treatments, including post-fire areas, if large-diameter ponderosa pines and other old-growth components remain (Raphael 1981, Raphael and White 1984, Raphael et al. 1987,Dixon 1995a, 1995b, Frenzel 2000, Wrightman et al. 2010). Average canopy closure at 66 nest sites studied by Frenzel (2000) was 12%.

Throughout the range, habitat components include an abundance of mature pines (with large cones and abundant seed production), relatively open canopy (50-70%), and availability of snags and stumps for nest cavities (Garrett et al. 1996). Understory vegetation is generally sparse within preferred habitat (Garrett et al 1996).

For the period 1997-2004, Frenzel (2004) found nesting success was 39% at nest sites in silvicultural treatments or sites with low densities of big trees as opposed to 61% for nests in uncut stands. Uncut sites had big tree (>21 in [53 cm] dbh) density >=12 trees/ac (0.4/ha)). White-headed woodpeckers foraged predominantly on large-diameter live ponderosa pine trees (Dixon 1995b). Ponderosa pine seeds are the most important vegetable food item in Oregon (Bull et al. 1986, Dixon 1995b) especially in winter.

Source habitat was defined in this analysis as:

- Potential vegetation: xp,dp, dd, dg
- Forest structure and size: single- and multi-layered stands with >20” dbh
- Canopy closure: < 40% canopy

Snag Density

Several studies have documented the importance of large-diameter ponderosa pine snags for white-headed woodpeckers (Dixon 1995a, b, Milne and Hejl 1989, Raphael and White 1984). Of 43 white-headed woodpecker in central Oregon (Dixon 1995b), 36 were in ponderosa pine snags, 2 in ponderosa pine stumps, 2 in quaking aspen snags, and 1 each in live quaking aspen, white-fir snag, and the dead top of a live ponderosa pine tree; most nest snags were moderately decayed. Nest tree size averaged 65 cm (dbh) and nest tree height averaged 14 m; excluding 1 nest 32 m high in a dead-topped live ponderosa pine, nest-cavity height averaged 4.4 m. In s.-central Oregon, all 16 nests studied by Dixon (1995a) were in completely dead substrates (37% in snags, 56% in stumps, and 6% in leaning logs). Mean size of nest trees was 80 cm (dbh), and nest tree height averaged 3 m.

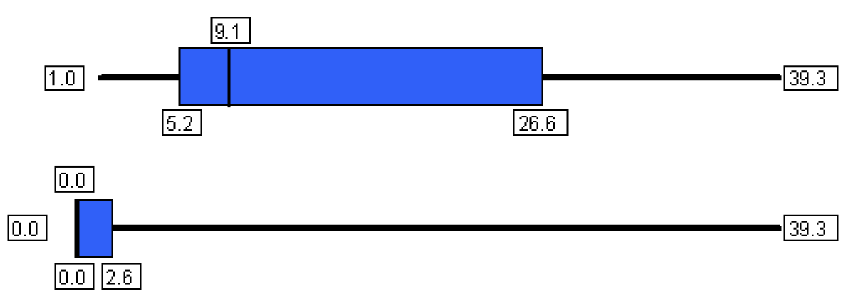
Frenzel (2004) found that of 405 nests of white-headed woodpeckers, all but 12 were in completely dead trees. Mean size of nest trees was 69 cm (27”) dbh (n=405), mean canopy closure at nest sites was 11.0%, and density of large trees >=50 cm (>21”) dbh was 6.1 trees/ 0.4ha.

We calculated the percentage of area of source habitat within each watershed that had snag (>50cm dbh) densities in the following classes based on data from Decaid (Mellen-McLean et al. 2009).

Potential Vegetation: xp, dp, dd

Low	0
Mod	0-1/ha
High	1-2.6/ha
Very high	>=2.6/ha

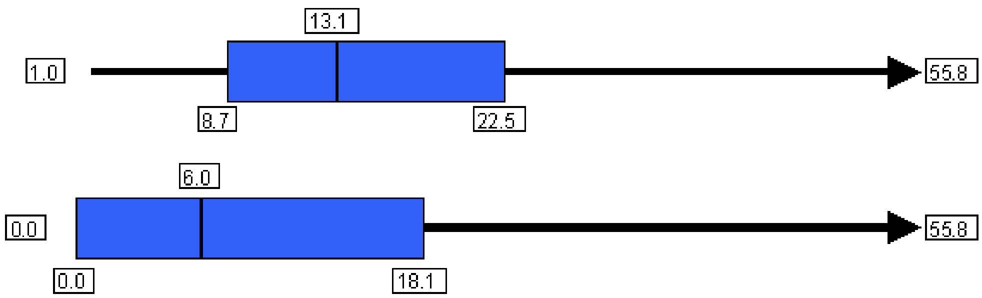
Figure PPDF_L.inv-3. 30%, 50%, and 80% tolerance levels, and range of densities (#/ha) of snags ≥ 50.0 cm dbh on unharvested inventory plots (n=14) that contained measurable snags (upper figure) and all unharvested inventory plots (n=70) (lower figure) in the Ponderosa Pine/Douglas-fir Forest, Larger Trees Vegetation Condition.



Potential Vegetation: dg

Low	0-1/ha
Moderate	1-6/ha
High	6-18/ha
Very High	>=18/ha

Figure EMC_ECB_L.inv-3. 30%, 50%, and 80% tolerance levels, and range of densities (#/ha) of snags ≥ 50.0 cm dbh on unharvested inventory plots (n=95) that contained measurable snags (upper figure) and all unharvested inventory plots (n=159) (lower figure)in the Eastside Mixed Conifer Forest, East Cascades/Blue Mountains, Larger Trees Vegetation Condition.



Road Density

We included a road density variable to account for likely reduced snag densities along roads. Bate et al. (2007) and Wisdom and Bate (2008), found that snag numbers were lower adjacent to roads due to removal for safety considerations, removal as firewood, and other management activities.

To account for reduced snag density along roads, we calculated road densities in the dry potential vegetation types into 4 classes:

Zero - <0.06 km/km2 open roads in HUC (<0.1 mi/mi2)
Low - 0.06-0.62 km/km2 open roads in HUC (0.1-1.0 mi/mi2)
Moderate - 0.63-1.24 km/km2 open roads in HUC (1.1-2.0 mi/mi2)
High - >1.24 km/km2 open roads in HUC (>2.0 mi/mi2)

Shrub Cover

Frenzel (2004) found that shrub cover was a significant variable in predicting nest success. Nest sites with <5% shrub cover had the highest mean nesting success of 61%. Nest success with shrub cover >5%, had a mean nest success of 42%.

Smith (2002) reported that densities of chipmunks in ponderosa pine habitat in central Oregon increased with shrub-cover, and densities of golden-mantled ground squirrels increased with amounts of down wood. Both of these species were cited by Frenzel

(2004) as nest predators of white-headed woodpeckers, suggesting that higher levels of shrubs and woody debris may lead to increased levels of predation.

Using GNN shrub density data, we calculated the percentage of source habitat with high (>15%) and low (<15%) shrub density per watershed.

Historical Inputs for Focal Species Assessment Model

Source habitat- Class 1
Snag density - Low 30%; Moderate 20%, High 30%, Very High 20%
Road density - Zero
Shrub density - Low

White-headed Woodpecker Watershed Index Model

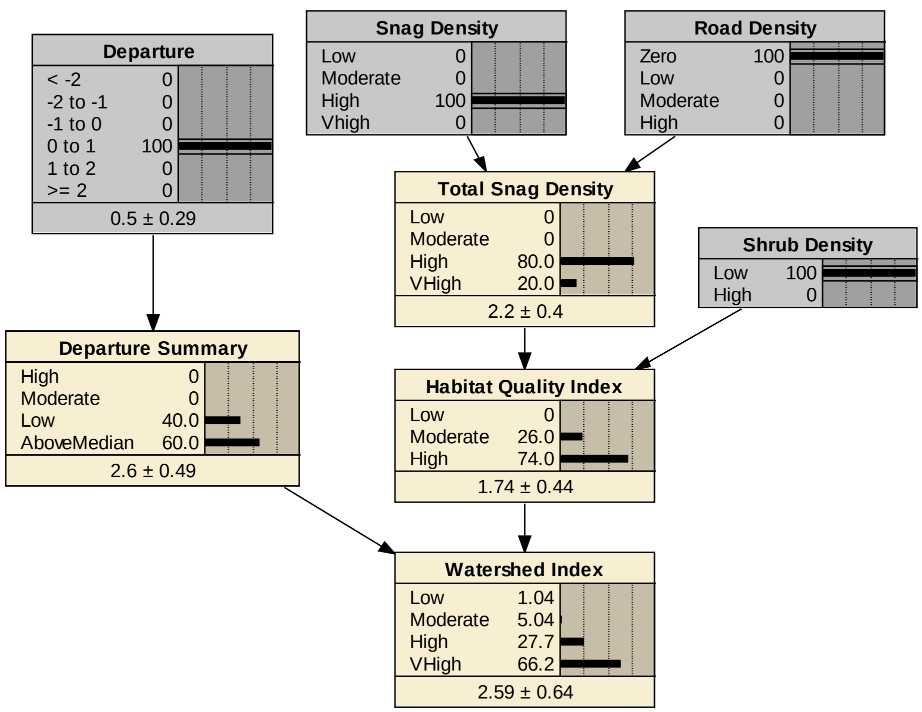


Figure –Focal species assessment model for white-headed woodpecker

Table -- Relative sensitivity of Watershed Index values to variables in the model for white-headed woodpecker

Variable	Sensitivity rank
Habitat departure	1
Snag density	2
Road density	3

Shrub density	4

Watershed Index Model Application

All watersheds are currently in class -3 departure class.

All watershed had low watershed index values (<1.0) due to loss of habitat.

		Departure	Watershed Index	Snag Density		Road Density		Shrub Density	
	#Water-sheds	Class -3	Low (<1.0)	Low/ Moderate	High/ VHigh	Zero/Low	Moderate/ High	Low	High
UMA	31	100%	100%	39% (n=12)	61% (n=19)	71% (n=22)	29% (n=9)	26% (n=8)	74% (n=23)
WAW	48	100%	100%	56% (n=27)	44% (n=21)	44% (n=21)	56% (n=27)	6% (n=3)	94% (n=45)
MAL	37	100%	100%	100%	0%	14% (n=5)	86% (n=32)	68% (n=25)	32% (n=12)
Blue Mtns	111	100%	100%	66% (n=73)	34% (n=38)	41% (n=45)	59% (n=66)	31% (n=34)	69% (n=77)

*snag densities- % of watersheds with >=50% of the source habitat in the different snag classes

**road densities - % of watersheds with >50% of potential habitat in the different road density classes

Viability Outcome

The VO model incorporated the weighted WI (WWI) scores (described earlier), and a habitat distribution index. The WWI scores indicated that the current habitat capability for the white-headed woodpecker within the planning area is <1% of the historic capability. Dispersal across the planning area was not considered an issue for this species. Currently the distribution of habitats across the forests were all Low. We estimated the current viability outcome was a 20% probability of class D and 80% probability of class E on all 3 Forests. These low outcomes indicate suitable environments are likely highly isolated and occur in very low abundance.

We estimated that historical conditions were much different for this woodpecker. Dispersal across the planning area was not considered an issue for this species. The viability outcome historically was estimated to be primarily an A outcome on all 3 Forests, indicating a broad distribution of abundant habitat.

Viability Outcome	Umatilla NF		Wallowa-Whitman NF		Malheur NF	
	Historical	Current	Historical	Current	Historical	Current
HisWWI/CurWWI	100	<1	100	<1	100	<1
%Hucs >=40%	74	0	71	0	78	0
Clusters	3/3	0/3	4/4	0/4	3/3	0/3
A	80	0	80	0	80	0
B	14	0	14	0	14	0
C	5	0	5	0	5	0
D	1	20	1	20	1	20
E	0	80	0	80	0	80

Figure – Historical and Current Viability Outcome white-headed woodpecker

In summary, under historical conditions, white-headed woodpeckers and other species associated with large-tree, open-canopied pine were likely well-distributed throughout the planning areas; currently they were likely not well-distributed and with low abundance of source habitat.

<u>Alternative B viability analysis</u>:

We evaluated the viability for the white-headed woodpecker for Alternative B in 2 time periods (year 20, and year 50) using the outputs of vegetation modeling. We assumed snag densities increased at ½ the rate as the change in modeled source habitat (e.g. if habitat increased 10%, snag densities in the 'high' category increased 5%). We assumed no change in the road density or shrub density attribute.

The reason we used snag densities at ½ the rate of habitat change is that management to restore dry forest habitat occupied by these species is designed to reduce fuels and thus reduce risk of fire, and insect outbreak. This management approach may result in reduction of snag densities due to consumption during prescribed burning and felling of snags for safety. Some snags will be created from the prescribed burning, but the overall effect is likely to result in lower snag densities (Agee2002, Bagne et al. 2007, Hessburg et al. 2010, Hurteau et al 2010, Gray and Blackwell 2008).

Habitat is projected to increase through year 50 on all 3 NFS. However, overall there is little change in the viability outcome for Alternative B in either year 20 or year 50 as compared to current. The projected viability outcome remains low primarily due to the low amount of open-canopied large tree forests as compared to the historical range of variability. All of the watersheds remain in the habitat departure class -3.

There are several plan components that protect source habitat, and address the risk factors associated with this species. There are desired conditions for snag densities to be retained at HRV levels, and several standards and guidelines that address conservation of larger trees, and limits to road construction. Additionally, as white-headed woodpeckers are associated with some post-fire habitats (Wrightman et al. 2010), some components assure that some important post-fire habitat components are maintained. The following table shows standard and guidelines that should benefit white-headed woodpecker habitat:

WLD-HAB-11 G-11	**Guideline** To the extent practical, known cavity or nest trees should be preserved when conducting prescribed burning activities, mechanical fuel treatments, and silvicultural treatments.
WLD-HAB-13 S-7	**Standard** Where management activities occur within dry or cool moist forest habitat, all snags 21 inches DBH and greater and 50 percent of the snags from 12 to 21 inches DBH shall be retained, except for the removal of danger/hazard trees. Snags shall be retained in patches.
WLD-HAB-16 G-4	**Guideline** Greater than 50 percent of post-fire source habitat should be retained and should not be salvage logged.
WLD-HAB-17 G-5	**Standard** Salvage logging shall not occur within burned source habitat areas less than 100 acres, except for the removal of danger/hazard trees.
WLD-HAB-18 G-6	**Guideline** Where salvage logging occurs, all snags 21 inches DBH and greater and 50 percent of the snags from 12 to 21 inches DBH should be retained except for the removal of danger/hazard trees. Snags should be retained in patches.
OF-1 G-59	**Guideline** Management activities in old forest stands should retain live old forest trees (≥ 21 inches DBH). Exceptions include: • old forest tree(s) need to be removed to favor hardwood species, such as aspen or cottonwood, or other special habitats • old forest late seral species, such as grand fir, are competing with large diameter early seral species, such as ponderosa pine • old forest tree(s) need to be removed to reduce danger/hazard trees along roads and in developed sites • a limited amount of old forest trees need to be removed where strategically critical to reinforce and improve effectiveness of fuel reduction in WUIs
OF-2 G-60	**Guideline** Management activities in non-old forest stands should retain live legacy old forest trees (≥ 21 inches DBH). Exceptions to retaining live legacy old forest trees are the same as those noted in the previous guideline (OF-1).
OF-3	**Guideline** New motor vehicle routes should not be constructed within old forest stands.

Viability Outcome	Umatilla NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		12,807	35,064	70,574
A	80	0.0	0	0

B	14	0.0	0	0
C	5	0	0	0
D	1	20	20	22
E	0	80	80	78

Viability Outcome	Wallowa-Whitman NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		13,833	31,989	56,044
A	80	0.0	0	0
B	14	0.0	0	0
C	5	0	0	0
D	1	20	20	20
E	0	80	80	80

Viability Outcome	Malheur NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		57,727	121,831	166,661
A	80	0.0	0	0
B	14	0.0	0	0
C	5	0	0	1
D	1	20	20	37
E	0	80	80	62

References:

Agee, J.K. 2002. Fire as a coarse filter for snags and logs. P. 359–368 in *Proc. of the Symposium on the ecology and management of dead wood in western forests, Reno, NV,* Laudenslayer, W.F., Jr., P.J. Shea, B.E. Valentine, C.P. Weatherspoon, and T.E. Lisle (eds.).US For. Serv. Gen. Tech. Rep. PSW-181.

Altman, B. 2000. Conservation Strategy for landbirds of the east-slope of the Cascade Mountains in Oregon and Washington. Version 1.0. June 2000. Am. Bird Conservancy and Oregon-Washington Partners in Flight.

Bagne K.E., Purcell. K.L., Rotenberry J.T.. 2007. Prescribed fire, snag population dynamics, and avian nest site selection. For. Ecol. Manag. 255:99–105.

Bate, L. J., Wisdom, M. J., Wales, B. C. 2007. Snag densities in relation to human access and associated management factors in forests of Northeastern Oregon, USA. Landscape and Urban Planning 80. pp 278-291.

Bull, E.L., S. R. Peterson and J. W. Thomas. 1986. Resource partitioning among woodpeckers in northeastern Oregon. U.S. Dept. Agric., For. Serv. Res. Note PNW-44.

Dixon, R.D. 1995a. Density, nest-site and roost-site characteristics, home-range, habitat-use, and behavior of White-headed Woodpeckers: Deschutes and Winema National Forests, Oregon. Oregon Dept. Fish and Wildl. Nongame Rep. 93-3-01.

Dixon, R.D. 1995b. Ecology of White-headed Woodpeckers in the Central Oregon Cascades. Master's thesis, Univ. of Idaho, Moscow.

Frenzel, R.W. 2000. Nest-sites, Nesting Success, and Turnover-rates of White-headed Woodpeckers on the Deschutes and Winema National Forests, Oregon in 2000. Unpublished Report, Oregon Natural Heritage Program, The Nature Conservancy, Portland.

Frenzel, R.W. 2004. Nest-sites, Nesting Success, and Turnover-rates of White-headed Woodpeckers on the Deschutes and Winema National Forests, Oregon in 2004. Unpublished Report, Oregon Natural Heritage Program, The Nature Conservancy, Portland.

Garrett, K. L., M.G. Raphael, and R. D. Dixon. 1996. White-headed Woodpecker (Picoides albolarvatus). In The birds of North America, No. 252 (A. Poole and F. Gill, eds.). The academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

Gray, R.W., Blackwell, B.A. 2008. The maintenance of key biodiversity attributes through ecosystem restoration operations. *IN* Narog, Marcia G., technical coordinator Proceedings of the 2002 fire conference: managing fire and fuels in the remaining wildlands and open spaces of the Southwestern United States. Gen. Tech. Rep. PSW-GTR-189. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 363 p

Hessburg, PF, Povak, NA., Salter, R.B. 2010. Thinning and prescribed fire effects on snag abundance and sptatial patter in an Eastern cascade range dry forest, Washington, USA. Forest Science Volume 56, Issue 1, pages 74-87

Hurteau, S., Sisk, T, Dickson B., Block, W. 2010. Variability in nest density, occupancy, and home range size of Western bluebirds after forest treatments. Forest Science 56(1):131-138

Marshall, D.B. 1997. Status of the White-headed Woodpecker in Oregon and Washington. Audubon Soc. Of Portland.

Marshall, D.M. 2003. White-headed Woodpecker. Pp. 364-366 *in* Birds of Oregon: A General Reference. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, OR.

Mellen-McLean, Kim, Bruce G. Marcot, Janet L. Ohmann, Karen Waddell, Susan A. Livingston, Elizabeth A. Willhite, Bruce B. Hostetler, Catherine Ogden, and Tina Dreisbach. 2009. DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 2.1. USDA Forest Service, Pacific Northwest Region and Pacific Northwest Research Station; USDI Fish and Wildlife Service, Oregon State Office; Portland, Oregon. http://www.fs.fed.us/r6/nr/wildlife/decaid/index.shtml

Milne, K. A., and S. J. Hejl. 1989. Nest-site characteristics of white-headed woodpeckers. J. Wildl. Manage. 53:50-55.

Raphael, M. G. 1981. Interspecific differences in nesting habitat of sympatric woodpeckers and nuthatches. Pp. 142-151 in The use of multivariate statistics in studies of wildlfie habitat (D. E. Capen, ed.). USDA For. Serv., Rocky Mtn. Forest and Range Exp. Stn., Gen. Tech. Rep. RM-87.

Raphael, M.G., and M. White. 1984. Use of snags by cavity-nesting birds of the Sierra Nevada. Wildl. Monogr. 86:1-66.

Raphael, M.G., M.L. Morrison, and M.P. Yoder-Williams. 1987. Breeding bird populations during twenty-five years of postfire succession in the Sierra Nevada. Condor 89:614-626.
Smith, T.G. 2002. Small mammal relationships with downed wood and antelope bitterbrush in ponderosa pine forest of central Oregon. M.S. Thesis. Oregon State Univ., Corvallis. 146pp.

Wisdom, M.J., R.S. Holthausen, B.C. Wales, [and others]. 2000. Source habitats for terrestrial vertebrates of focus in the Interior Columbia Basin: broad-scale trends and management implications. USDA Forest Service, PNW-GTR-485.

Wisdom, M. J. and L. J. Bate. 2008. Snag density varies with intensity of timber harvest and human access. Forest Ecology and Management 255:2085–2093.

Wightman, C. S., V. A. Saab, C. Forristal, K. Mellen-McLean, and A. Markus. 2010. White-headed woodpecker nesting ecology after wildfire. *Journal of Wildlife Management* **7**4: 1098–1106.

WESTERN BLUEBIRD (*Sialia mexicana*) MODEL APPLICATION AND ASSESSMENT RESULTS

Introduction

The western bluebird was identified as the focal species for the Open-forest/All forest Group because it is widely distributed in open, low-elevation forests, and is limited by the availability of snags with existing cavities. The bluebird represents the array of risk factors of snags and grazing common to other members of the group. Some species in the Group use down wood; it is assumed that if snags are present for the bluebird down wood will be available as snags fall. Western bluebirds are summer residents in Oregon.

Source Habitat Description

Western bluebirds are found in open coniferous and deciduous woodlands; wooded riparian areas; grasslands; farmlands; and burned, moderately logged, and edge areas with scattered trees, snags, or other suitable nest and perch sites (Guinan et al. 2000). In

Oregon, this species is common in Douglas fir (*Pseudotsuga menziesii*) and open pine forests east of Cascade Range and less common in juniper woodlands. In ponderosa pine and pine-oak forests, abundance was inversely related to canopy cover, and highest where canopy cover was <20% (Rosenstock 1996). In the western Cascades, this species breeds in snags in clearcuts and in and around the Willamette Valley, in open country with scattered trees and in orchards (Gilligan et al. 1994). In w. Oregon, Hansen et al. (1995) estimated mean bluebird densities were greatest at approximately 4 trees/ha and declined to zero at approximately 20 trees/ha (for all stems >10-cm dbh) in the Western Cascades.

These bluebirds have shown a preference for areas with an open overstory and are abundant in moderately disturbed areas, including moderately logged forests (Szaro 1976, Franzreb 1977), and burned areas (Johnson and Wauer 1996, Saab and Dudley 1998, Haggard and Gaines 2001), where sufficient nest sites and foraging perches avail-able. Western bluebirds have been found to respond favorably to restoration treatments in dry forests (Wrightman and Germaine 2006, Gaines et al. 2007, Gaines et al. 2008). Restoration of Ponderosa pine forests by thinning of dense stands, followed by control burns and reseeding, increased nest and fledgling success, and decreased predation (Germaine and Germaine 2002).

Studies have varied results on effects of fire and salvage logging in burned forests to western bluebirds and other cavity nesters (Guinan et al 2000). In Washington, following 2 different salvage treatments following wildfire, there was a higher abundance of western bluebirds in areas of low snag density, but more nests in areas of medium to high snag density (Haggard and Gaines 2001). In Idaho, there were more western bluebird nests in areas of low – medium snag density than in higher snag density areas following a stand replacement fire (Saab and Dudley 1998). In Arizona forest with no salvage logging, higher western bluebird abundance was in severely burned than in unburned areas (Dwyer and Block 2000). We identified source habitat as forests as:

- Potential Vegetation: xp, dp, dd, dg
- Tree size – All (not shrub stage)
- Canopy cover - <40%

Snag Density

Nests of western bluebirds are usually found in rotted or previously excavated cavities in trees and snags, or between trunk and bark (Guinan et al. 2000). In norther nArizona Western bluebirds preferred snags over live trees for nesting; 70% of nests (n = 33) found in snags, in addition in areas where snag density was low, researchers found the birds switched to live trees for nests (Cunningham et al. 1980).

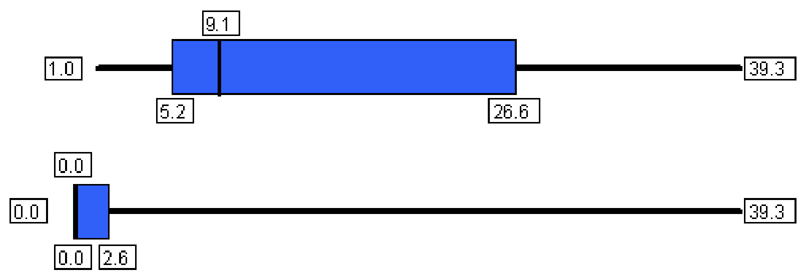
There is often a high degree of inter- and intraspecific competition among cavity nesters for nest sites. Competition for nest sites has increased with the invasion of European starlings, house sparrows, and tree swallows (Herlugson 1980, Hedges 1994, Gillis

1989). On a burned site in southwestern Idaho, Lewis' woodpeckers (Melanerpes lewis) frequently usurped western bluebird nests, sometimes ejecting nestlings (Saab and Dudley 1995). We calculated percent of source habitat within a watershed that had densities of snags >50.0 cm dbh in the following classes (per hectare):

Potential Vegetation: xp, dp, dd:

Low	0
Mod	0-1
High	1-2.6
Very high	>=2.6

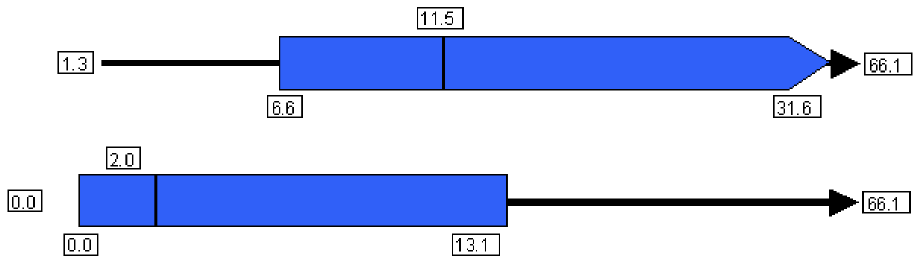
Figure PPDF_L.inv-3. 30%, 50%, and 80% tolerance levels, and range of densities (#/ha) of snags ≥ 50.0 cm dbh on unharvested inventory plots (n=14) that contained measurable snags (upper figure) and all unharvested inventory plots (n=70) (lower figure) in the Ponderosa Pine/Douglas-fir Forest, Larger Trees Vegetation Condition.



Potential Vegetation: dg:

Low	0-1
Moderate	1-2
High	2-13
Very High	>=13.1

Figure EMC_ECB_O.inv-3. 30%, 50%, and 80% tolerance levels, and range of densities (#/ha) of snags ≥ 50.0 cm dbh on unharvested inventory plots (n=55) that contained measurable snags (upper figure) and all unharvested inventory plots (n=117) (lower figure)in the Eastside Mixed Conifer Forest, East Cascades/Blue Mountains, Open Canopy Vegetation Condition.



These density classes were derived from Decaid (Mellen-McLean et al. 2009).

Road Density

We analyzed road to evaluate the potential of reduced snag densities along roads. Bate et al. (2007), found that snag numbers were lower adjacent to roads due to removal for safety considerations and removal as firewood. Other research has found reduced snag abundance along roads (Wisdom and Bate 2008). Our snag density data came from a modeled data set that did not account for road associated factors (Ohman and Gregory 2002)

We calculated the percent of source habitat in the following road density classes:
Zero - <0.06 km/km2 open roads in HUC (<0.1 mi/mi2)
Low - 0.06-0.62 km/km2 open roads in HUC (0.1-1.0 mi/mi2)
Moderate - 0.63-1.24 km/km2 open roads in HUC (1.1-2.0 mi/mi2)
High - >1.24 km/km2 open roads in HUC (>2.0 mi/mi2)

Grazing

Livestock grazing is thought to have contributed to reduced fire frequency in ponderosa pine forests through the elimination of grass that facilitated the spreading of low-intensity fires (Zwartjes et al. 2005). The depletion of competing grasses and lack of fire in turn encouraged the growth of shrubs and dense stands of young conifers (Chambers and Holthausen 2000; Touchan et al. 1996). Dense ponderosa pine forests that resulted from reduced frequency of low-intensity fires are at a greater risk of catastrophic fires (Chambers and Holthausen 2000; Touchan et al. 1996).

A great reduction in grass biomass, due to grazing, is likely to negatively impact the prey base for western bluebirds (Zwartjes et al. 2005). In addition Bull et al. (2001), found western bluebirds to be more abundant at ponds that were protected from livestock grazing than those not protected.

We categorized the amount of potential habitat in an active grazing allotment using 10% increments from 0-100%, with increasing poorer habitat outcomes as the proportion of potential habitat in an active allotment increased.

Historical Inputs for Focal Species Assessment Model

Source habitat departure -Class 1
Snag density - Low 30%; Moderate 20%, High 30%, and Very High 20%
Road density - Zero
Grazing – Zero

Western Bluebird Watershed index model:

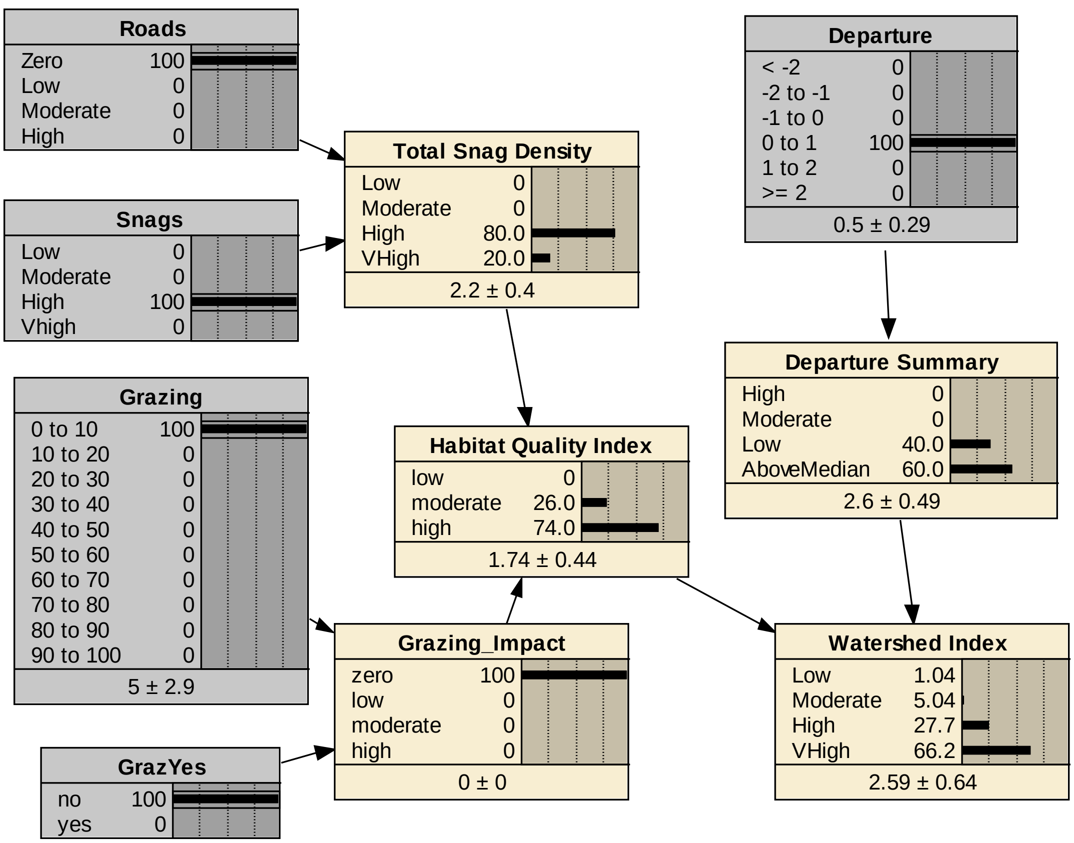


Figure -- Focal species assessment model for Western bluebird**.**

Table -- Relative sensitivity of Watershed Index values to variables in the model for western bluebird

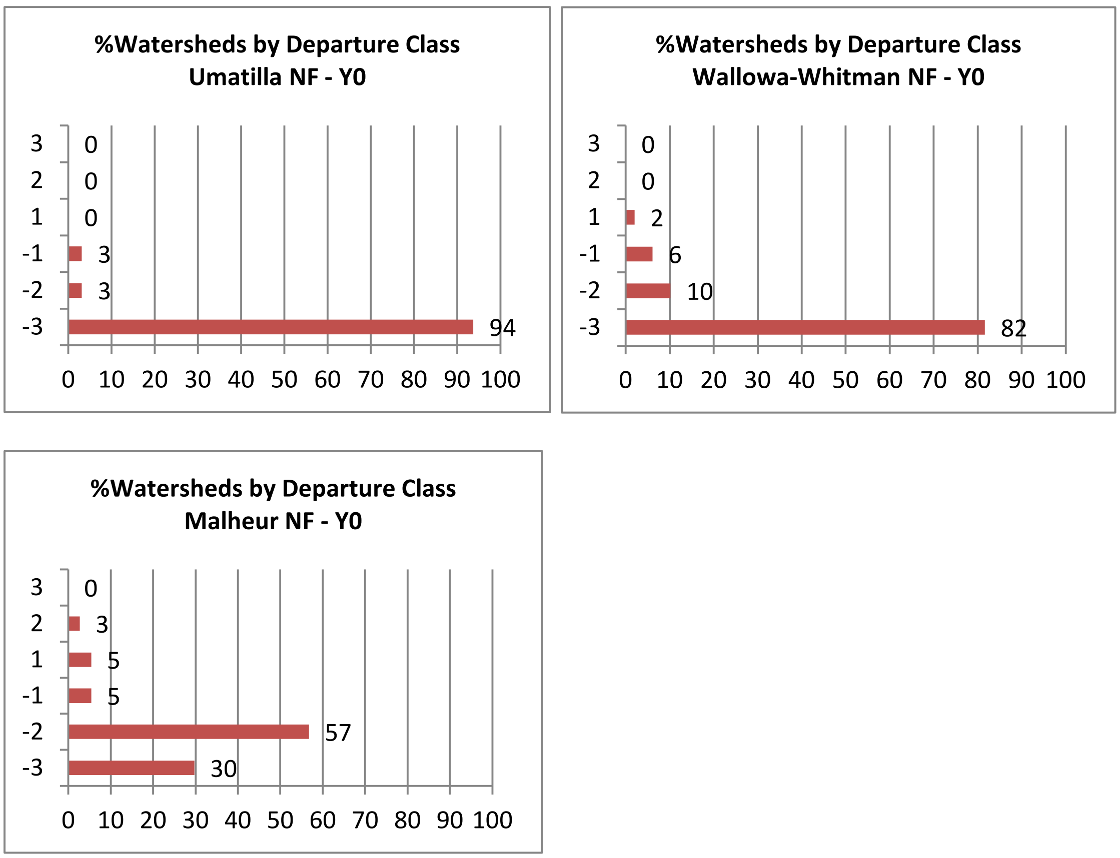
Variable	Sensitivity rank
Habitat departure	1
Snag density	2

Grazing	3
Road density	4

Watershed Index Model Application

Watershed index values were primarily low (<1.0). The three watersheds with the greatest watershed index values were Willow Cr (MAL), Grindstone (MAL) and McKay Cr (WAW).

Habitat for Western bluebirds was well below the historical median of source habitat in nearly all watersheds.



Figures: Percent of watersheds in the different departure classes for the current time period.

Although loss of habitat had the greatest effect on the watershed index evaluation, snag densities were also relatively low, and road densities were relatively high.

Greater than 50% of the source habitat in 85% of the watersheds (n=97) had low snag densities (<1/ha), while 3% (n=3) watersheds had very high snag densities in >50% of the source habitats. Historically we projected that 50% of the habitat would have Low or Moderate snag densities and 50% would have High to Very high snag densities.

Road densities were generally in the high or moderate classes (>=0.63km/km2; >=1.1-2.0 mi/mi2) as 60% (n=67) watersheds fell in this class, though 15% (n=17) did have zero open road densities in >50% of their source habitat.

Grazing levels were generally high as 80% of the watersheds (n=87) had >50% of the potential habitat in an active grazing allotment.

		Snag Density		%Grazing	Road Density	
	#Watersheds	Low/ Moderate	High/ Vhigh	>=50%	Zero/ Low	Moderate/ High
UMA	32	66% (n=21)	34% (n=11)	72% (n=23)	53% (n=17)	28% (n=9)
WAW	49	90% (n=44)	10% (n=5)	63% (n=31)	43% (n=21)	57% (n=28)
MAL	37	97% (n=36)	3% (n=1)	97% (n=36)	14% (n=5)	86% (n=32)
Blue Mtns	113	86% (n=97)	14% (n=16)	78% (n=88)	41% (n=46)	59% (n=67)

*snag densities- % of watersheds with >=50% of the source habitat in the different snag classes

**road densities - % of watersheds with >50% of potential habitat in the different road density classes

Viability Outcome

The VO model incorporated the weighted WI (WWI) scores (described earlier), and a habitat distribution index. Currently the likelihood of viability of western bluebirds was much reduced since historical conditions. The WWI scores indicated that the current habitat capability for the western bluebird within the planning area is <=20% of the historic capability on all 3 Forests.

Dispersal across the Blue Mountains planning area was not considered an issue for this species. All clusters currently contained at least 1 watershed with >40% of the median amount of historical source habitat. Overall distribution on each Forest was primarily High. Due to the low abundance of source habitat, the viability outcome on each Forest is primarily a D.
A 'D' outcome indicates suitable environments are at low abundance and/or are low to moderately distributed.

It is likely that historically western bluebirds would have had primarily an 'A' outcome with habitat broadly distributed and abundant across the Blue Mountains. Raphael et al. 2001, also found a decline from historical in their evaluation of habitats across the entire interior Columbia basin for western bluebirds, however, though measured differently and with different data, not as great of a decline was measured.

Viability Outcome	Umatilla NF		Wallowa-Whitman NF		Malheur NF	
	Historical	Current	Historical	Current	Historical	Current
HisWWI/CurWWI	100	3	100	6	100	20
%Hucs >=40%	72	47	69	53	78	68
Clusters	3/3	3/3	4/4	4/4	3/3	3/3
A	80	0	75	0	80	0
B	14	0	18	0	14	0
C	5	6	6	7	5	8
D	1	66	1	67	1	68
E	0	28	0	26	0	25

Figure – Historical and Current Viability Outcome Western Bluebird

Alternative B viability analysis:

We evaluated the viability for the western bluebird for Alternative B in 2 time periods (year 20, and year 50) using the outputs of vegetation modeling. We assumed snag densities increased at ½ the rate as the change in modeled source habitat (e.g. if habitat increased 10%, snag densities in the 'high' category increased 5%). We assumed no change in the road density or grazing attribute.

The reason we used snag densities at ½ the rate of habitat change is that management to restore dry forest habitat occupied by these species is designed to reduce fuels and thus reduce risk of fire, and insect outbreak. This management approach may result in reduction of snag densities due to consumption during prescribed burning and felling of snags for safety. Some snags will be created from the prescribed burning, but the overall effect is likely to result in lower snag densities (Agee 2002, Bagne et al. 2007, Hessburg et al. 2010, Hurteau et al 2010, Gray and Blackwell 2008).

Habitat is projected to increase on all 3 NFs through year 50. However, overall there is little change in the viability outcome for Alternative B in either year 20 or year 50 as compared to current. The projected viability outcome remains low primarily due to the low amount of open-canopied forests as compared to the range of variability. The majority of watersheds remain in the habitat departure classes of -2 or -3. Road densities and grazing levels remained the same which were relatively high and low respectively in the current condition modeling.

Viability Outcome	Umatilla NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		202,642	291,919	361,610
A	80	0	0	0
B	14	0	0	0
C	5	6	7	64
D	1	66	67	36
E	0	28	26	0

Viability Outcome	Wallowa-Whitman NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		259,112	347,097	404,524
A	75	0	0	0
B	18	0	0	0
C	6	7	7	7
D	1	67	67	67
E	0	26	26	26

Viability Outcome	Malheur NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		680,762	692,110	663,543
A	80	0	0	0
B	14	0	0	0
C	5	8	8	8
D	1	68	68	68
E	0	25	24	25

There are several plan components that protect source habitat, and address the risk factors associated with this species. There are desired conditions for snag densities to be retained at RV levels, and several standards and guidelines that address conservation of larger trees, and limits to road construction. Additionally, as these bluebirds are associated with some post-fire habitats (Saab and Dudley 1998, Haggard and Gaines 2001), some components assure that some important post-fire habitat components are maintained. The following table shows standard and guidelines that should benefit western bluebird habitat:

WLD-HAB-11 G-11	**Guideline** To the extent practical, known cavity or nest trees should be preserved when conducting prescribed burning activities, mechanical fuel treatments, and silvicultural treatments.
WLD-HAB-13 S-7	**Standard** Where management activities occur within dry or cool moist forest habitat, all snags 21 inches DBH and greater and 50 percent of the snags from 12 to 21 inches DBH shall be retained, except for the removal of danger/hazard trees. Snags shall be retained in patches.
WLD-HAB-16 G-4	**Guideline** Greater than 50 percent of post-fire source habitat should be retained and should not be salvage logged.
WLD-HAB-17 G-5	**Standard** Salvage logging shall not occur within burned source habitat areas less than 100 acres, except for the removal of danger/hazard trees.
WLD-HAB-18 G-6	**Guideline** Where salvage logging occurs, all snags 21 inches DBH and greater and 50 percent of the snags from 12 to 21 inches DBH should be retained except for the removal of danger/hazard trees. Snags should be retained in patches.
OF-1 G-59	**Guideline** Management activities in old forest stands should retain live old forest trees (≥ 21 inches DBH). Exceptions include: • old forest tree(s) need to be removed to favor hardwood species, such as aspen or cottonwood, or other special habitats • old forest late seral species, such as grand fir, are competing with large diameter early seral species, such as ponderosa pine • old forest tree(s) need to be removed to reduce danger/hazard trees along roads and in developed sites • a limited amount of old forest trees need to be removed where strategically critical to reinforce and improve effectiveness of fuel reduction in WUIs
OF-2 G-60	**Guideline** Management activities in non-old forest stands should retain live legacy old forest trees (≥ 21 inches DBH). Exceptions to retaining live legacy old forest trees are the same as those noted in the previous guideline (OF-1).
OF-3	**Guideline** New motor vehicle routes should not be constructed within old forest stands.

Literature Cited:

Agee, J.K. 2002. Fire as a coarse filter for snags and logs. P. 359–368 in *Proc. of the Symposium on the ecology and management of dead wood in western forests, Reno, NV,* Laudenslayer, W.F., Jr., P.J. Shea, B.E. Valentine, C.P. Weatherspoon, and T.E. Lisle (eds.).US For. Serv. Gen. Tech. Rep. PSW-181.

Bagne K.E., Purcell. K.L., Rotenberry J.T.. 2007. Prescribed fire, snag population dynamics, and avian nest site selection. For. Ecol. Manag. 255:99–105.

Bate, L. J., Wisdom, M. J., Wales, B. C. 2007. Snag densities in relation to human access and associated management factors in forests of Northeastern Oregon, USA. Landscape and Urban Planning 80. pp 278-291.

Brawn, J. D.; Balda, R. P. 1988. Population biology of cavity nesters in northern Arizona: do nest sites limit breeding densities? Condor. 90: 61-71.

Bull, Evelyn L.; Deal, Jerry W.; Hohmann, Janet E. 2001. Avian and amphibian use of fenced and unfenced stock ponds in northeastern Oregon forests. Res. Pap. PNW-RP-539. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 9 p.

Chambers, C. L.; Holthausen, R. S. 2000. Montane ecosystems used as rangelands. In: Jemison, R.; Raish, C., eds. Livestock management in the American Southwest: ecology, society, and economics. Amsterdam: Elsevier Science: 213-280.

Cunningham, James B.; Balda, Russell P.; Gaud, William S. 1980. Selection and use of snags by secondary cavity-nesting birds of the ponderosa pine forest. Res. Pap. RM-222. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 15 p.

Dwyer, Jill K.; Block, William M. 2000. Effects of wildfire on densities of secondary cavity-nesting birds in ponderosa pine forests of northern Arizona. In: Moser, W. Keith; Moser, Cynthia E., eds. Fire and forest ecology: innovative silviculture and vegetation management. Tall Timbers Fire Ecology Conference Proceedings, No. 21. Tallahassee, FL: Tall Timbers Research Station: 151-156. http://www.fs.fed.us/rm/pubs_other/rmrs_2000_dwyer_j001.pdf

Franzreb, K. E.. 1977. Bird population changes after timber harvesting of a mixed conifer forest in Arizona. U.S. For. Serv., Res. Pap. RM-184.

Gaines, W. L, Haggard, M., Lehmkuhl, J. F., Lyons, A. L. Harrod, R.J. 2007. Short-term Response of Land Birds to Ponderosa Pine Restoration . Journal of Restoration Ecology 15:4 pp.666-674.

Gaines, W.L, Haggard, M.; Begley, J., Lehmkuhl,J., Lyons, A. 2010. Short-Term Effects of Thinning and Burning Restoration Treatments on Avian Community Composition, Density, and Nest Survival in the Eastern Cascades Dry Forests, Washington. Forest Science, 56: 1 pp. 88-99

Germaine, H. L., and S. S. Germaine. 2002. Forest restoration treatment effects on the nesting success of Western Bluebird (Sialia mexicana). Restoration Ecology 10:326–367.

Gillis, Earl. 1989. Western bluebirds, tree swallows & violet-green swallows west of the Cascade Mountains in Oregon, Washington & Vancouver Island, BC. Sialia. 11(4): 127-130.

Gilligan, J., Smith, D. Rogers, and A.Contreras. 1994. Birds of Oregon: status and distribution. Cinclus Publ., McMinnville, OR.

Guinan, J.A., P.A. Gowaty, and E.K. Eltzroth. 2000. Western bluebird (Sialia mexicana). In The birds of North America, No. 510 (A.Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Gray, R.W., Blackwell, B.A. 2008. The maintenance of key biodiversity attributes through ecosystem restoration operations. *IN* Narog, Marcia G., technical coordinator Proceedings of the 2002 fire conference: managing fire and fuels in the remaining wildlands and open spaces of the Southwestern United States. Gen. Tech. Rep. PSW-GTR-189. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 363 p

Haggard, Mary Ellen, and William L. Gaines. 2001. Effects of stand-replacement fire and salvage logging on a cavity-nesting bird community in eastern Cascades, Washington. NW Science. 75(4):387-396.

Hansen, A., W. Mccomb, R. Vega, M. Raphael and M. Hunter. 1995. Bird habitat relationships in natural and managed forests in west Cascades of Oregon. Ecological Applications 5:555-569.

Hedges, Steven. 1994. Utah's bluebirds. Utah Birds. 10(1): 7-8.

Hejl, Sallie J. 1994. Human-induced changes in bird populations in coniferous forests in western North America during the past 100 years. Studies in Avian Biology. 15: 232-246.

Herlugson, Christopher Jan. 1980. Biology of sympatric populations of western and mountain bluebirds. Pullman, WA: Washington State University. 133 p. Dissertation.

Hessburg, PF, Povak, NA., Salter, R.B. 2010. Thinning and prescribed fire effects on snag abundance and sptatial patter in an Eastern cascade range dry forest, Washington, USA. Forest Science Volume 56, Issue 1, pages 74-87

Hurteau, S., Sisk, T, Dickson B., Block, W. 2010. Variability in nest density, occupancy, and home range size of Western bluebirds after forest treatments. Forest Science 56(1):131-138

Johnson, T. H., and R. H. Wauer. 1996. Avifaunal response to the 1977 La Mesa fire. Pages 70–94 *in* C. D. Allen, technical editor. Fire effects in Southwestern forests. Proceedings of the Second La Mesa Fire Symposium. USDA Forest Service General Technical Report RM-GTR-286.

Ohman J.L., Gregory M.J. 2002. Predictive mapping of forest composition and structure with direct gradient analysis and nearest-neighbor imputation in coastal Oregon, U.S.A. *Can. J. For. Res*. 32: 725–741.

Rosenstock, S. S. 1996. Habitat relationships of breeding birds in northern Arizona ponderosa pine and pine-oak forests. Arizona Game and Fish Dep., Tech. Rep. 23.

Raphael, M. G., M. J. Wisdom, M. M. Rowland, R. S. Holthausen, B. C. Wales, B. G. Marcot, and T. D. Rich. 2001. Status and trends of habitats of terrestrial vertebrates in relation to land management in the interior Columbia River basin. Forest Ecology and Management 153:63–87.

Saab, Victoria, and Jonathan Dudley. 1998. Responses of cavity-nesting birds to stand-replacement fire and salvage logging in ponderosa pine/Douglas-fir forests of southwestern Idaho. USDA Forest Service, Rocky Mtn. Res. Sta., Ogden, UT. Res. Paper RMRS-RP-11. 17 p.

Szaro, Robert Chester. 1976. Population densities, habitat selection, and foliage use by the birds of selected ponderosa pine areas in the Beaver Creek Watershed, Arizona. Flagstaff, AZ: Northern Arizona University. 264 p. Dissertation.

Touchan, R.; Allen, C. D.; Swetnam, T. W. 1996. Fire history and climatic patterns in ponderosa pine and mixed-conifer forests of the Jemez Mountains, northwestern New Mexico. In: Allen, C. D., tech. ed. Fire effects in Southwestern forests: proceedings of the second La Mesa fire symposium. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 33-46.

Wrightman, C.S., Germaine, S.S. 2006. Forest stand characteristics altered by restoration affect Western bluebird habitat quality. Restoration Ecology 14 (4). Pp 653-661.

Wisdom, M.J., R.S. Holthausen, B.C. Wales, [and others]. 2000. Source habitats for terrestrial vertebrates of focus in the Interior Columbia Basin: broad-scale trends and management implications. USDA Forest Service, PNW-GTR-485.

Wisdom, M. J. and L. J. Bate. 2008. Snag density varies with intensity of timber harvest and human access. Forest Ecology and Management 255:2085–2093.

Zwartjes, P. W.; Cartron, J.-L. E.; Stoleson, P. L. L.; Haussamen, W. C.; Crane, T. E. 2005. Assessment of Native Species and Ungulate Grazing in the Southwest: Terrestrial Wildlife. Gen. Tech. Rep. RMRS-GTR-142. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 73 p.

FOX SPARROW (*Passerella iliaca)* MODEL APPLICATION AND ASSESSMENT OF RESULTS

Introduction

Fox sparrows were chosen as a focal species to represent species in the Early Successional Group of the Open Forest Family. They preferred dense, low shrub growth typical of such habitats and were susceptible to the effects of grazing by domestic livestock similar to other species in this group. Fox sparrows are breeding season residents of the planning area this assessment was for breeding and rearing habitat.

Model Description

Source Habitat

Fox sparrows were strongly associated with riparian shrubs (e.g., willow [*Salix* spp.], alder [*Alnus* spp.]) (Webster 1975) and the shrub stage of succession following fire and clearcut logging in mature forests (Hagar 1960, Banks 1970, Kirk and Hobson 2001, Simon et al. 2002, Weckstein et al. 2002, Machtans and Latour 2003, Fontaine et al. 2009). Densities of fox sparrows were reported highest in stands with heavy salvage logging following fire, intermediate in moderately salvaged stands, and lowest in the unsalvaged stands (Cahall and Hayes 2009). Although the early stages of the shrub successional stage were preferred (e.g., 3-15 years) (Hagar 1960, Meslow and Wight 1975), they also used shrub habitats for up to 30 years after disturbance (Simon et al. 2002). Residual trees remaining after clearcut logging (especially conifers) resulted in reduced densities of fox sparrows (Simon et al. 2002). In Oregon, fox sparrows use thick, shrubby vegetation along rivers, in forests, at forest edges, clearings, in chaparral or other shrubby vegetation areas. Frequents willow riparian habitats in desert mountain rangers. They also use patches of manzanita and buckbrush in open ponderosa pine woodlands. Avoid vast expanses of desert (Csuti et al. 1997). Hejl (1995) reported that fox sparrows were generally more abundant in either tall-shrub and/or pole-sapling clearcuts than in untreated areas.

Abundance of fox sparrows was significantly correlated with mean shrub height (Anderson 2007, Olechnowski and Debinski 2008). Tall shrubs without tree cover were preferred, but tall shrubs with residual tree cover were used to a lesser extent. Densities of fox sparrows ($r = 0.80$) were positively correlated with shrub volume (Cahall and Hayes 2009). Cover types representing early seral shrubs and forest reinitiation and regeneration following timber harvest and fire were included as source habitats. Shrub-steppe (i.e., arid shrub) land cover classes were not included.

Potential Vegetation: cd, cm, dg, dd, dp

Size class: Stand initiation, Grass, and Shrub (<5” dbh) (VDDT classes)

Canopy: open (<10%)

Grazing

The results reported in the literature on the effects of grazing on fox sparrows were unequivocal. Page et al. (1978), Knopf et al. (1988), Schulz and Leininger (1991), and Saab (1998) all reported a negative response from fox sparrows associated with cattle grazing. Other researchers have also found fox sparrows to be less abundant in areas where vegetative structure of shrubs had been altered by browsing (Berger et al. 2001, Olechnowski and Debinski 2008).

Although fox sparrows were parasitized by brown-headed cowbirds (which were often associated with livestock grazing operations), it occurred infrequently (Friedmann 1963).

The impact of grazing on source habitat within a watershed was based on percentage of source habitat in that watershed within an active grazing allotment. The amount of potential habitat in an active grazing allotment was categorized using 10% increments from 0-100%, with increasing poorer habitat outcomes as the proportion of potential habitat in an active allotment increased.

Variables Considered But Not Included

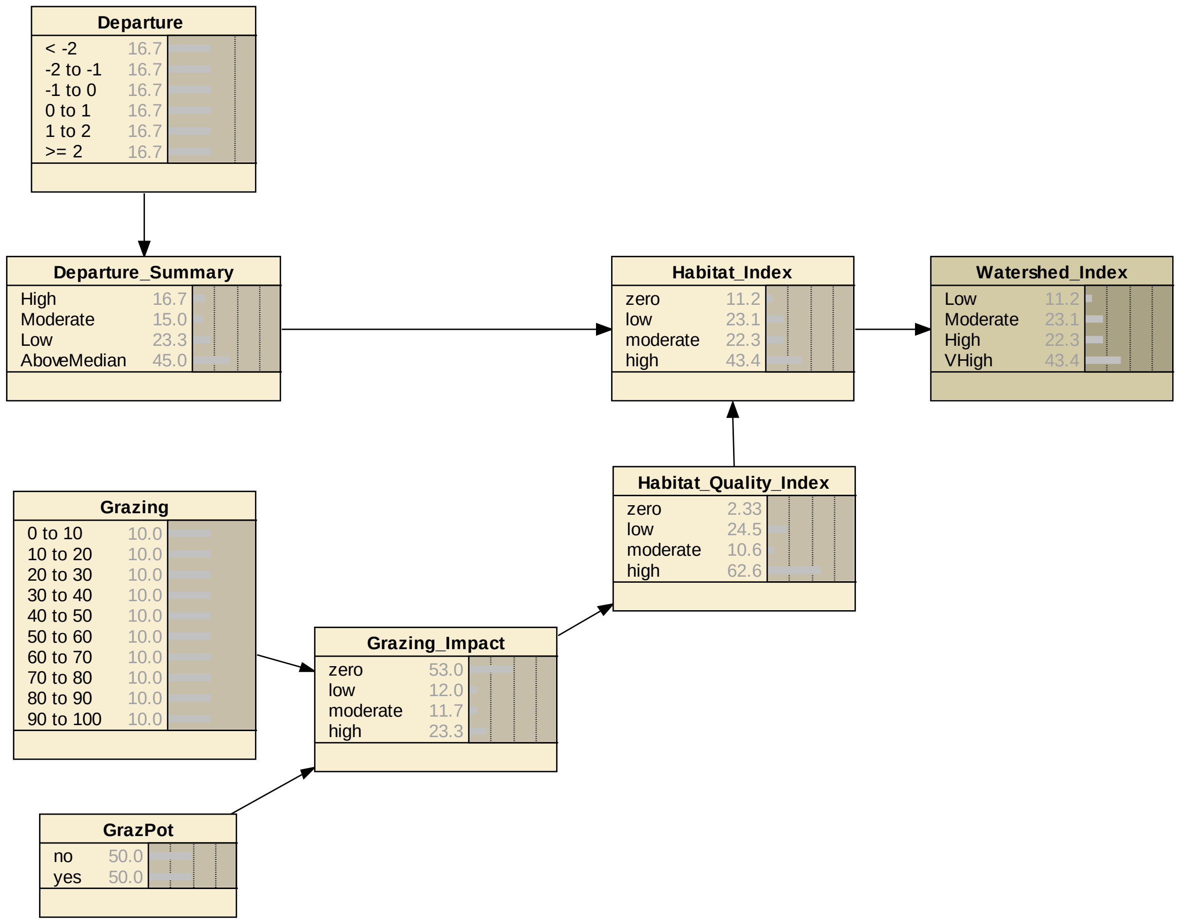
Shrub Cover

The amount of shrub cover was directly related to habitat quality for fox sparrow. Low shrub cover greatly diminishes the value of an area as habitat for fox sparrows. High shrub cover greatly increases the quality of habitat for fox sparrows. Fires tend to eliminate shrub cover and reduce habitat quality for fox sparrow (Samuels et al. 2005). This variable was addressed in the northeast Washington study area as the proportion of source habitat that had >70% shrub cover as determined from gradient nearest neighbor analysis (Ohmann and Gregory 2002). We attempted to use this variable in the Blue Mountain assessment area, however, the abundance of shrubs in source habitats in the data set available was primarily <10%. Because the variable varied so greatly from the suggested values in the Washington assessment area, we felt better not using the variable.

Calculation of Historical Conditions

Values of the model variables were set with the following values to estimate historical habitat conditions:
Departure of source habitat from HRV – Class 1
Grazing – none

Watershed Index Model



Figure—Focal species assessment model for fox sparrow.

Table—Relative sensitivity of Watershed Index values to variables in the model for fox sparrow.

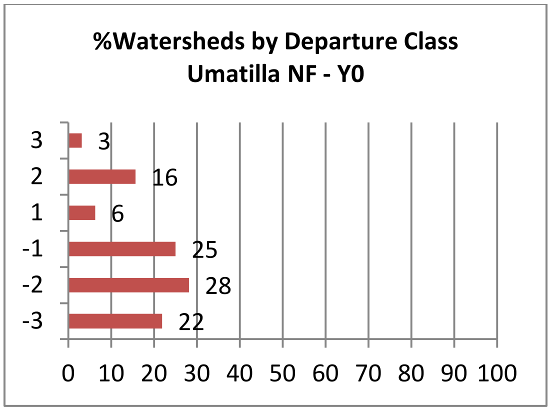
Variable	Sensitivity rank
Habitat departure	**1**
Grazing impact	**2**

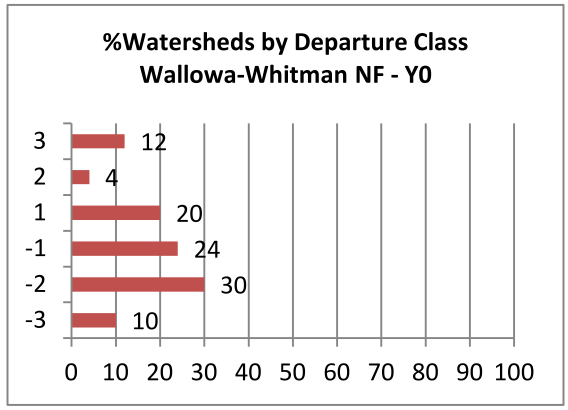
Assessment Results – Current Condition

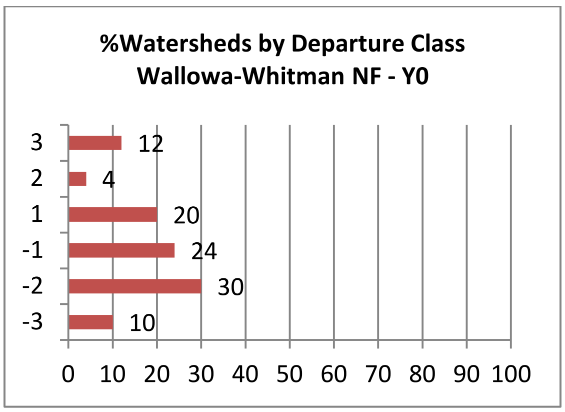
Habitat Influences

We assessed 114 watersheds that had over 20 ha of potential habitat. Nearly all watersheds (46%, n=52) low Watershed Index (WI) scores (i.e., <1.0).

The primary factors that influenced the WI scores was the amount of source habitat compared to levels historically available in the watersheds. (Figures habitat departures)







Percentage of potential habitat within an active grazing allotment was used to assess the impact of grazing to fox sparrows and ranged from 0 to 100% by watershed. Overall grazing was high (see Table).

		%Potential Habitat grazed		
	# Watersheds	<10%	10-50%	>=50%
UMA	32	6% (n=2)	22% (n=7)	72% (n=23)
WAW	50	24% (n=12)	22% (n=11)	54% (n=27)
MAL	37	0%	5% (n=2)	95% (n=35)

Viability Outcome Scores

The VO model incorporated the weighted WI (WWI) scores (described earlier), and a habitat distribution index. The WWI scores indicated that the current habitat capability for fox sparrow across the 3 planning areas was 38% on the Umatilla, 41% on the Wallowa-Whitman and 14% on the Malheur NF. Dispersal across the planning area was not considered an issue for this species. All of the clusters currently contained at least 1 watershed with >40% of the median amount of historical source habitat (median was calculated across all watersheds with source habitat).Viability outcomes on the Umatilla and Wallowa-Whitman NFs were primarily a C outcome currently while on the Malheur, habitat has declined more, the outcome was projected to be primarily a D/E. Outcomes were likely similar for other species in the Early Successional Group of the Open Forest Family.

Historically, dispersal across the planning area was not considered an issue for this species. We estimated that distribution of habitat was likely High. Under those circumstances there was an 80% probability that the historical viability outcome for fox sparrow was class A indicating that habitat was broadly distributed and in high abundance.

Viability Outcome	Umatilla NF		Wallowa-Whitman NF		Malheur NF	
	Historical	Current	Historical	Current	Historical	Current
HisWWI/CurWWI	100	38	100	41	100	14
%Hucs >=40%	72	50	74	58	78	30
Clusters	3/3	3/3	4/4	4/4	3/3	3/3
A	80	0	80	0	80	0
B	14	0	14	22	14	0
C	5	64	5	72	5	3
D	1	36	1	6	1	55
E	0	0	0	0	0	42

Figure—Viability classes for fox sparrows and other species in the Early Successional Group of the Open Forest Family under historical and current conditions

In summary, under historical conditions, fox sparrows and other species in the Early Successional Group of the Open Forest Family were likely well-distributed throughout the planning area; currently they were likely not well-distributed, and in lower abundance.

Alternative B Viability Analysis

We evaluated the viability for Fox Sparrow for Alternative B in 2 time periods (year 20, and year 50) using the outputs of vegetation modeling. We assumed the one risk factor, grazing to remain the same through all time periods.

Overall there is a decline in source habitat at year 20, and then an overall increase at year 50 on the Umatilla and Wallowa-Whitman NFs and the viability outcome does not change under this alternative. On the Malheur NF, habitat abundance and distribution increase through year 50 leading to an increase in viability to primarily a C outcome in year 50.

Overall the amount of early seral source habitat remains well below the historical median and amount of source habitat in an active allotment remains high.

Although we were unable to model the density of shrubs within source habitat, the encouragement of shrub development (e.g. G47) and grazing utilization guidelines should benefit this species.

The objectives and desired condition statements in Alternative B emphasize the desire to increase the amount and quality of understory communities that are source habitat for fox sparrows. In addition to uplands, fox sparrows will likely benefit from potential habitat protection and restoration efforts in riparian areas.

WLD-HAB-30 G-13	**Guideline** Vigor and areal extent of seed producing grasses and forbs should not be reduced.
WLD-HAB-27 G-12	**Guideline** Where management activities occur within riparian habitat, the quantity, stature, and health of shrubs should not be reduced or degraded.
WLD-HAB-28 G-14	**Guideline** Roads and trails should not be constructed within high elevation riparian areas.

RNG-4 G-46	**Guideline** In areas classified as less than fully capable or suitable, only limited grazing should be authorized or allowed only after the limitations of the site are considered in designing the site-specific allotment management plan.
RNG-6 G-47	**Guideline** Shrub utilization should not exceed 45 percent. This should be based on mean annual vegetative production.

Viability Outcome	Umatilla NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat		139,119	123,326	168,112

Acres				
A	80	0	0	0
B	14	0	0	23
C	5	64	64	73
D	1	36	36	5
E	0	0	0	0

Viability Outcome	Wallowa-Whitman NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		200,549	174,814	218,707
A	80	0	0	0
B	14	22	0	23
C	5	72	65	73
D	1	6	35	5
E	0	0	0	0

Viability Outcome	Malheur NF		Alt B	Alt B
	Historical	Current	Y20	Y50
S.Habitat Acres		105,657	121,435	174,782
A	80	0	0	0
B	14	0	0	0
C	5	3	7	65
D	1	55	67	35
E	0	42	26	0

References:

Anderson, E. M. 2007. Changes in bird communities and willow habitats associated with fed elk. Wilson Journal of Ornithology 119:400–409

Banks, R. 1970. The fox sparrow on the west slope of the Oregon Cascades. Condor 72:369-370.

Berger, J.; Stacey, P.B.; Bellis, L.B., and Johnson, M.P. 2001. A mammalian predator-prey imbalance: grizzly bear and wolf extinction affect avian neotropical migrants. Ecological Applications 11: 947–960.

Cahall RE, Hayes JP. 2009. Influences of postfire salvage logging on forest birds in the Eastern Cascades, Oregon, USA. For. Ecol. Manage.257:1119-1128.

Csuti, B., Kimerling, A.J., O'Neil, T.A., Shaughnessy, M.M., Gaines, E.P. and M.M.P. Huso. 1997. Atlas of Oregon Wildlife. Oregon State University Press, Corvallis, OR.

Friedmann, H. 1963. Host relations of the parasitic cowbirds. U.S. National Museum Bulletin 233. 5.

Fontaine J,B, Donato D,C, Robinson W,D, Law B,E, Kauffman J,B.2009. Bird communities following high-severity fire: response to single and repeat fires in a mixed-evergreen forest, Oregon, USA. For. Ecol. Manage.257:1496-1504.

Hagar, D. C. 1960. The interrelationships of logging, birds, and timber regeneration in the Douglas-fir region of northwestern California. Ecology 41:116-125.

Hejl, S. J.; Hutto, R. L.; Preston, C. R.; Finch, D. M. 1995. Effects of silvicultural treatments in the Rocky Mountains. Pp. 55-84. In: T. E. Martin and D. M. Finch, eds. Ecology and management of Neotropical migratory birds. Oxford Univ. Press. Oxford, UK. 489pp.

Kirk, D. A., and K. A. Hobson. 2001. Bird-habitat relationships in jack pine boreal forests. Forest Ecology and Management 147:217-243.

Knopf, F. L., J. A. Sedgwick, and R. W. Cannon. 1988. Guild structure of a riparian avifauna relative to seasonal cattle grazing. Journal of Wildlife Management 52:280-290.

Machtans, C. S., and P. B. Latour. 2003. Boreal forest songbird communities of the Liard Valley, Northwest Territories, Canada. Condor. 105: 27–44.

Meslow, E. C., and H. M. Wight. 1975. Avifauna and succession in Douglas-fir forests of the Pacific Northwest. Pages 266-271 *in* D.R. Smith, coordinator. Proceedings of the symposium on management of forest and range habitats for nongame birds. USDA Forest Service General Technical Report WO-1

Ohmann, J. L., and M. J. Gregory. 2002. Predictive mapping of forest composition and structure with direct gradient analysis and nearest neighbor imputation in the coastal province of Oregon, USA. Canadian Journal of Forest Research 32:725-741.

Olechnowski, B.M, Debinski, D.D. 2008. Response of songbird to riparian willow habitat structure in the greater Yellowstone ecosystem. Wilson Journal of ornithology 120 (4):830-839.

Page, J. L., N. Dodd, T. O. Osborne, and J. A. Carson. 1978. The influence of livestock grazing on non-game wildlife. California Nevada Wildlife 1978:159-173.

Saab, V. A. 1998. Effects of recreational activity and livestock grazing on habitat use by breeding birds in cottonwood forests along the South Fork Snake River. USDI Bureau of Land Management Tech. Bull. 98-17. Boise, ID

Samuels, I. A., T. Gardali, D. L. Humple, and G. R. Geupel. 2005. Winter site fidelity and body condition of three riparian songbird species following a fire. Western North American Naturalist 65:45-52.

Schulz, T. T., and W. C. Leininger. 1991. Non-game wildlife communities in grazed and ungrazed Montana riparian sites. Great Basin Naturalist 51:286-292.

Simon, N. P. P., F. E. Schwab, and R. D. Otto. 2002. Songbird abundance in clear-cut and burned stands: a comparison of natural disturbance and forest management. Canadian Journal of Forest Research 32:1343–1350.

Smith, M. R., P. W. Mattocks, Jr., and K. M. Cassidy. 1997. Breeding birds of Washington State. Volume 4 in K. M. Cassidy, C. E. Grue, M. R. Smith, and K.M. Dvornich, editors. Washington State gap analysis – final report. Seattle Audubon Society Publications in Zoology 1, Seattle, WA, USA.

Webster, J. D. 1975. The fox sparrow in southwestern Yukon and adjacent areas. Condor 77:215-216.

Weckstein, J. D., D. E. Kroodsma, and R. C. Faucett. 2002. Fox sparrow (*Passerella iliaca*) *in* A. Poole and F. Gill, editors. The Birds of North America, No. 715. The Birds of North America, Inc., Philadelphia, Pennsylvania, USA.

BLACK-BACKED WOODPECKERS (*Picoides arcticus*) MODEL APPLICATION AND ASSESSMENT OF RESULTS

Introduction

Black-backed woodpeckers were chosen as focal species for the post-fire Group. They represent post-fire habitat with a relatively high density of trees and snags, as compared to other species in the group. Black-backed woodpecker's have been reported to exist at higher densities and are more productive in post-fire habitats than in other forest conditions in which they occur. They range across the planning area and are sensitive to salvage activities, making them a good focal species. These birds are resident throughout the planning area.

Model Variables

Source Habitat

Black-backed woodpeckers are associated with boreal and montane coniferous forest especially in areas with standing dead trees such as burns (Dixon and Saab 2000). This bird is extremely restricted in its use of habitat types and is strongly associated with recently burned forests (Raphael and White 1984, Hutto 2006, Nappi and Drapeau 2009, Saab and Dudley 1998). In the northern Rocky Mountains of the United States, a region-wide landbird survey and extensive literature review revealed that the species is almost exclusively associated with recently burned forests (< 5 years), although it is occasionally observed in mixed conifer, lodgepole pine, Douglas-fir, and spruce-fir forests (Hutto 1995a, 1995b). Several studies have found that in recently burned forests, black-backed woodpecker nest sites were found at higher densities and had higher nest success in areas with high densities of standing snags, and unsalvaged (Haggard and Gaines 2001, Saab and Dudley 1998, Saab et al. 2009).

In California, these woodpeckers occurred in burned sites six to eight years after fire, but were not recorded during surveys 15-19 years and 21-25 years post-fire, although they were present in very low densities during all periods in unburned control plots (Raphael et al. 1987). Hutto (1995b) suggests that a mosaic of recently burned forests may best represent source habitat, where local reproduction exceeds mortality. Several researchers have suggested that the low densities of woodpeckers in unburned forests may indicate sink populations that are maintained by birds that move into these areas as conditions on post-fire habitats become less suitable over time (Hutto 1995b, Murphy and Lehnhausen 1998, Saab et al. 2005, Nappi and Drapeau 2009). However, Goggans et al. (1988) suggested that this species be an indicator species for mature and old-growth lodgepole pine stands in Oregon, and Trembly et al (2009) suggested the use of black-backed woodpecker as an indicator species, in mature and overmature coniferous stands in northeastern North America.

For this species we considered both a primary and secondary source habitat in all forested potential vegetation types.

Primary source habitat:

- Potential vegetation types: dp, dd, dg, cm, cd
- Post-fire habitat 1999-2006

Secondary source habitat:

- Potential vegetation types: dp, dd, dg, cm, cd
- Tree size: >=10” dbh,
- Canopy closure: >=40% in the dry, >=60% in cm, cd

Snag Densities (in secondary habitat)

Black-backed woodpeckers nest in both live and dead trees, but may require heartrot for nest excavation (Goggans et al. 1988). Nests are usually in a conifer such as pine, spruce, fir, or Douglas-fir (Scott et al. 1977). In Idaho, used nest trees averaging 32.3 centimeter dbh (N = 15; Saab and Dudley 1998). In a study in the Sierra Nevada, California, black-backed woodpeckers favored partially dead trees and hard snags for nesting; used nest trees > 41 centimeter dbh and > 13 meters tall in both burned and unburned forest (Raphael and White 1984). Mean dbh of nest trees reported in this study was 40 cm, nest-tree height 28 m, and nest-cavity height averaged 11 m. Of 15 nests in north-east Oregon, 9 nests were located in snags and 6 in live trees; most (10) were in ponderosa pine, 4 in lodgepole pine, and 1 in western larch (Bull et al. 1986). They also reported that nest trees averaged 37 cm dbh, 19 m in height, and 5 m as nest-cavity height.

This woodpecker forages predominantly on wood-boring beetles, engraver beetles, and mountain pine beetles (Harris 1982, Villard and Beninger 1993, Goggans et al. 1988, Dixon and Saab 2000).. In central Oregon, they foraged pre-dominantly on lodgepole pine trees with a mean dbh of 36 cm ± 12 SD (range 5–99, *n* = 330); dead trees were used in greater proportion than available, and most were recently dead; 81% of forage trees were infested with mountain pine beetle; mean foraging height 5.0 m ± 3.4 SD (range 0–18.0, *n* = 339; Goggans et al. 1988). In a burned, mixed-conifer forest in northeast Washington, these woodpeckers foraged predominantly on dead trees 99% of the time (Kreisel and Stein 1999). Woodpeckers as a group that included black-backed woodpeckers selected trees or snags greater than 44cm dbh to forage on in a recent foraging study on the Wenatchee NF (Lyons et al. 2008).

We assumed that snag densities preferred by the species were available in primary habitat (post-fire). In secondary habitat we calculated the percent area of source habitat within each watershed that had snag (>25cm dbh) densities in the following classes based on data from decaid of: low <=9/ha, moderate 10-18/ha, high 19-45/ha, and very high >=45 snags/ha 9. The breaks between classes are based on averaged DECAID (Mellen-McLean et al 2009) data for Ponderosa Pine/Douglas fir, Mesic, and Montane forests snags >25cm and expert opinion.

Road Density

Bate et al. (2007) and Wisdom and Bate (2008), found that snag numbers were lower adjacent to roads due to safety considerations, firewood cutters, and other management activities. To account for reduced snag density along all roads, we calculated the percentage of secondary potential habitat in the following road density classes by watershed:

Zero - <0.06 km/km2 open roads in watershed (<0.1 mi/mi2)
Low - 0.06-0.62 km/km2 open roads in watershed (0.1-1.0 mi/mi2)
Moderate - 0.63-1.24 km/km2 open roads in watershed (1.1-2.0 mi/mi2)
High - >1.24 km/km2 open roads in watershed (>2.0 mi/mi2)

Historical Inputs for Focal Species Assessment Model

Primary Habitat Departure – Class 1
Secondary Habitat Departure – Class 1
Snag Density - Low 30%; Moderate 20%, High 30%, Very High 20%
Road Density - Zero

Black-backed Woodpecker Watershed Index Model

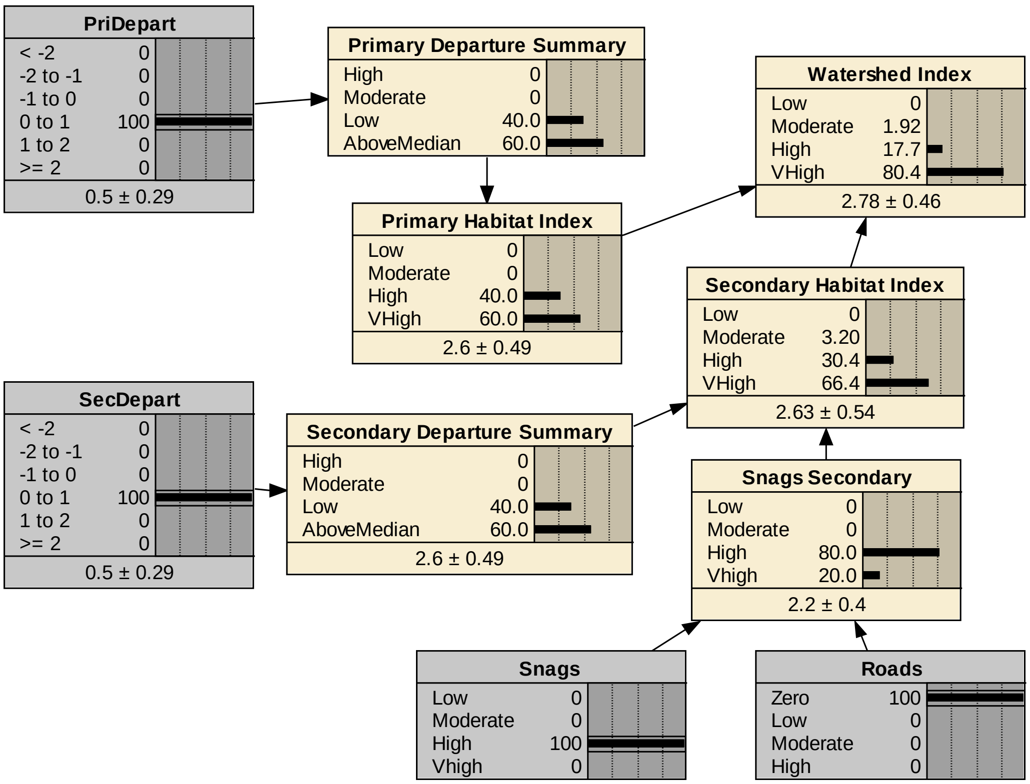
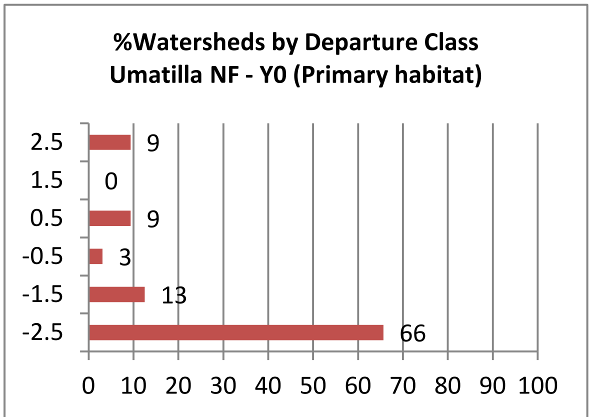


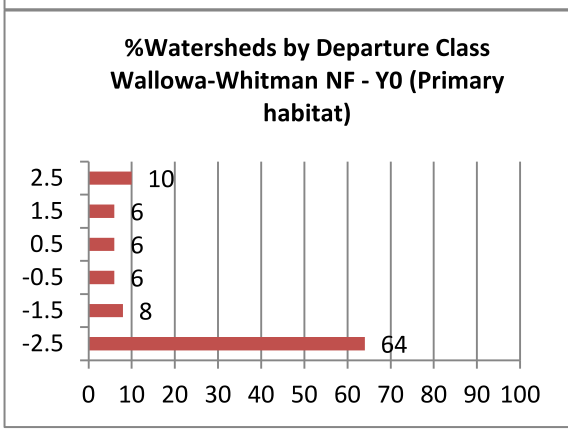
Table -- Relative sensitivity of Watershed Index values to variables in the model for black-backed woodpecker

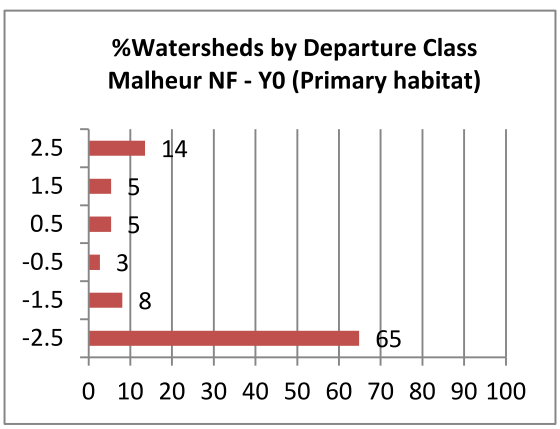
Variable	Sensitivity rank
Primary habitat departure	1
Secondary habitat departure	2
Snags Secondary	3
Road Density	4

Assessment Results

Watershed Index Scores







Figures - Primary Habitat Departure - Current

It is likely that recent fire management policies have negatively impacted this species by reducing the number of large, high intensity wildfires that create suitable conditions for the black-backed woodpecker (Dixon and Saab 2000).

The departure of secondary source habitat from historical conditions was not as departed for nearly all watersheds on all 3 Forests departure was either at or above the historical median.

Overall snag densities in secondary source habitat were low or moderate (<=18/ha) on the Malheur NF and high or very high on the other 2 Forests.

Overall road densities were in the moderate to high classes.

		Snag Density		Road Density	Watershed Index		
	# Water-sheds	Low/Moderate	High/Vhigh	Moderate/High	Low (<1)	Moderate (1-2)	High (>=2)
UMA	32	28% (n=9)	72% (n=23)	28% (n=9)	0%	75% (n=24	25% (n=8)
WAW	50	36% (n=18)	64% (n=32)	46% (n=23)	4% (n=2)	66% (n=33)	30% (n=15)
MAL	37	89% (n=33)	11% (n=4)	87% (n=32)	13% (n=5)	60% (n=22)	27% (n=10)

*snag densities- % of watersheds with >=50% of the source habitat in the different snag classes
**road densities - % of watersheds with >50% of potential habitat in the different road density classes

Because primary post-fire habitat is well below the historical median in most watersheds, the amount of secondary habitat is likely playing an important role. The distribution of watersheds with >40% of historical median is leading to lower distribution scores, leading to the lower viability outcomes.

Important to realize is that we only analyzed fires through 2006, recent large fires especially on the Malheur NF, likely created primary source habitat yet were not included in our analysis. Additionally, we may have overestimated the amount of primary (post-fire) habitat overall, as we included all areas within the fire boundaries, limited areas were salvage harvested (including roadside safey zones), and in some areas we likely included areas that were non-forested or had low tree density prior to the fire. Additionally, black-backed woodpeckers prefer post-fire habitat in the short-term following a fire (e.g. <5 years Saab et al 2007), we may have overestimated the amount of post-fire habitat.

Viability Outcome

The VO model incorporated the weighted WI (WWI) scores (described earlier), and a habitat distribution index. The WWI scores indicated that the current habitat capability for black-backed woodpeckers within the planning area is >80% of the historic capability on all 3 Forests.

Currently, one cluster on the Malheur does not contain at least at least 1 watershed with >40% of the median amount of historical primary source habitat (median was calculated across all watersheds with source habitat).

The number of watersheds that have >40% of the median amount of historical primary source habitat ranges from 28-32% on all 3 Forests. The distribution of primary habitat is largely responsible for the decline in viability since historical.

Historically, all clusters contained at least 1 watershed with >40% of the median amount of historical source habitat (median was calculated across all watersheds with source habitat), and over 70% had >40% of the median amount of historical source habitat.

Historically the outcome was primarily an A indicating that suitable environments were once abundant, broadly distributed and better connected.

Viability Outcome	Umatilla NF		Wallowa-Whitman NF		Malheur NF	
	Historical	Current	Historical	Current	Historical	Current
HisWWI/CurWWI	100	90	100	89	100	106
%Hucs >=40%	72	28	74	32	78	27
Clusters	3/3	3/3	4/4	4/4	3/3	2/3
A	80	10	80	29	80	0
B	14	25	14	34	14	23
C	5	41	5	28	5	58
D	1	26	1	11	1	19
E	0	0	0	0	0	0

Between 1960 and 1979, an average 4,400 acres per year were burned by wildfires in the Blue Mountains, compared to an average of 26,500 acres per year from 1980 to 2000 (Countryman 2008). Although currently the total amount of post-wildfire habitat is above the historical median, our analysis shows that these post-fire habitats are not distributed evenly across the watersheds. It is unknown how the distribution of primary source habitat for this species was distributed historically. The main factor leading to a lower viability outcome from historical was the decreased percentage of watersheds and distribution post-tire habitat across all clusters. Fire suppression efforts; have likely reduced the amount and distribution primary habitat for this species, and likely other species in the Post-fire Group, leading to reduced viability.

Alternative B analysis:

	Historical median	Current	Y20	Y50
Black-backed Woodpecker	Uma	Uma	Uma	Uma
S.Habitat_ acresPRI		69,848	18,666	38,375
%Potential_ primary	3	6	2	3
S.Habitat_ acresSEC		571,885	628,685	518,988
%Potential_ secondary	27	46	52	43

	Historical median	Current	Y20	Y50
Black-backed Woodpecker	WaW	WaW	WaW	WaW
S.Habitat_ acresPRI		70,809	32,047	58,832
%Potential_ primary	3	4	2	4
S.Habitat_ acresSEC		829,349	854,012	720,511
%Potential_ secondary	26	50	52	44

	Historical median	Current	Y20	Y50
Black-backed Woodpecker	Mal	Mal	Mal	Mal
S.Habitat_ acresPRI		55,431	27,659	39,018
%Potential_ primary	2	4	2	3
S.Habitat_ acresSEC		488,883	598,101	584,163
%Potential_ secondary	15	36	45	44

Our analysis of the trend in postfire habitat through year 20 under Alternative B, shows approximated a 50% reduction as compared to the amount of post-fire habitat that occurred in the last 20 years. Again, it may be that we over-estimated the amount of this habitat currently due to inclusion of non-forested habitat. A reduction in post-fire habitat could lead to decrease in the viability of this species. Additionally, a reduction in the amount of post-fire habitat could lead to a reduction in the distribution as well. The trend in, the amount of secondary habitat generally remains at or above the historical median which benefits this species.

Several plan components of Alternative B emphasize protection of large snags and trees in both primary and secondary habitats:

WLD-HAB-2 G-2	**Guideline** Areal extent of existing late old structure stands within the moist and cold old forest types that are 300 acres or larger should not be reduced or fragmented.
WLD-HAB-11 G-11	**Guideline** To the extent practical, known cavity or nest trees should be preserved when conducting prescribed burning activities, mechanical fuel treatments, and silvicultural treatments.
WLD-HAB-13 S-7	**Standard** Where management activities occur within dry or cool moist forest habitat, all snags 21 inches DBH and greater and 50 percent of the snags from 12 to 21 inches DBH shall be retained, except for the removal of danger/hazard trees. Snags shall be retained in patches.
WLD-HAB-21 G-5 *Changed to standard*	**Standard** Salvage logging shall not occur within burned source habitat areas less than 100 acres, except for the removal of danger/hazard trees.
WLD-HAB-22 G-6	**Guideline** Where salvage logging occurs, all snags 21 inches DBH and greater and 50 percent of the snags from 12 to 21 inches DBH should be retained except for the removal of danger/hazard trees. Snags should be retained in patches.
OF-1 G-59	**Guideline** Management activities in old forest stands should retain live old forest trees (≥ 21 inches DBH). Exceptions include: • old forest tree(s) need to be removed to favor hardwood species, such as aspen or cottonwood, or other special habitats • old forest late seral species, such as grand fir, are competing with large diameter early seral species, such as ponderosa pine • old forest tree(s) need to be removed to reduce danger/hazard trees along roads and in developed sites • a limited amount of old forest trees need to be removed where strategically critical to reinforce and improve effectiveness of fuel reduction in WUIs
OF-2 G-60	**Guideline** Management activities in non-old forest stands should retain live legacy old forest trees (≥ 21 inches DBH). Exceptions to retaining live legacy old forest trees are the same as those noted in the previous guideline (OF-1).
OF-3 *New*	**Guideline** New motor vehicle routes should not be constructed within old forest stands.

It is important to understand there is a lot of uncertainty with predicting fire severity and size in the northwest. Historically much of the dry forest vegetation group was dominated by low to mixed severity wildfires, while today, much of these areas have potential for high severity fires. While fuel treatments may reduce this severity, predicted changes in temperature and precipitation for the Pacific Northwest are expected to increase the risks associated with high severity fires and increase the area burned by wildfires (Littell et al. 2010). Additionally the amount of fire suppression is not expected to change under any alternative.

Summary – Under Alternative B, the overall projected amount of post-fire habitat is reduced from current though remains close to the historical median. Likely the distribution of these habitats will not be even across the planning area. The amount of secondary source habitat is projected to increase and this is likely important habitat for this species. Although fuel treatments, fire suppression and salvage logging may negatively affect the abundance of primary habitat for this species, likely high severity fires will occur under alternative B.

References;

Bate, L. J., Wisdom, M. J., Wales, B. C. 2007. Snag densities in relation to human access and associated management factors in forests of Northeastern Oregon, USA. Landscape and Urban Planning 80. pp 278-291.

Bull, E. L., S. R. Peterson and J. W. Thomas. 1986. Resource partitioning among woodpeckers in northeastern Oregon. USDA For. Serv. Pac. Northw. Res. Station, Portland, Ore., Res. Note PNW-444. 19 pp.

Dixon, R.D., Saab, V.A. 2000. Black-backed Woodpecker (Picoides arcticus). In The Birds of North America, No. 509 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Dudley, J.G. 2005. Home range size and foraging habitat of black-backed woodpeckers. Master's Thesis. Boise State University, Boise, ID. 76pp**.**

Forristal, C.D. 2009. Influence of postfire salvage logging on black-backed woodpecker nest-site selection and nest-site slelection and nest survival. M.S. Thesis Montana State University, Bozeman, MT.

Goggans, R. 1989. Black-backed woodpecker (Picoides arcticus). Pages 88-89 IN: Clark, T.W., A.H. Harvey, R.D. Dorn, D.L. Genter, and C. Groves, eds. Rare, sensitive, and threatened species of the greater Yellowstone ecosystem. Northern Rockies Conservation Cooperative, Jackson, WY.

Goggans, R., R. D. Dixon and L. C. Seminara. 1988. Habitat use by Three-toed and Black-backed woodpeckers, Deschutes National Forest, Oregon. Oregon Department of Fish and Wildlife - Nongame Wildlife Program Report 87-3-02. 43pp.

Haggard, M., Gaines, W.L., 2001. Effects of stand replacement fire and salvage logging on a cavity-nesting bird community in eastern Cascades. Washington NW. Sci. 75, 387–396.

Harris, M. A. 1982. Habitat use among woodpeckers in forest burns. M.S. thesis. University of Montana, Missoula. 62 pp.

Hutto, R.L. 1995a. USFS Northern Region Songbird Monitoring Program: Distribution and habitat relationships. USDA Forest Service Northern Region internal report, Missoula, MT.

Hutto, R.L. 1995b. Composition of bird communities following stand-replacement fires in northern Rocky Mountain (U.S.A.) conifer forests. Conservation Biology 9:1041-1058.

Hutto, R.L. 2006. Toward meaningful snag-management guidelines for postfire salvage logging in North American conifer forests. Conservation Biology 20:4 984-993.

Lyons, A.L., Gaines, W.L., Lehmkuhl, J.F., Harrod, R.J. 2008. Short-term effects of fire and fire surrogate treatments on foraging tree selection by cavity-nesting birds in dry forests of central Washington. Forest Ecology and Management, 255 (8-9), pp. 3203-3211.

Kotliar, N.B, Hejl, S.J., Hutto, R.L., Saab, V.A., Melcher, C.P., McFadzen, M.E. 2002. Effects of fire and post-fire salvage logging on avian communities in conifer-dominated forests of the western United States. Studies in Avian Biol. 25: 49-64.

Kreisel, K.J., and Stein, S.J. 1999. Bird use of burned and unburned coniferous forests during winter. Wilson Bull. 111: 243–250

Mellen-McLean, Kim, Bruce G. Marcot, Janet L. Ohmann, Karen Waddell, Susan A. Livingston, Elizabeth A. Willhite, Bruce B. Hostetler, Catherine Ogden, and Tina Dreisbach. 2009. DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 2.1. USDA Forest Service, Pacific Northwest Region and Pacific Northwest Research Station; USDI Fish and Wildlife Service, Oregon State Office; Portland, Oregon. http://www.fs.fed.us/r6/nr/wildlife/decaid/index.shtml

Murphy, E.C., Lehnhausen, W.A. 1998. Density and foraging ecology of woodpeckes following a stand-replacement fire. Jrnl Wildl Manage V62:4 pp1359-1372

Nappi, A., Drapeau, P., Giroux, J., Savard, J.L., 2003. Snag use by foraging blackbacked woodpeckers (Picoides arcticus) in a recently burned eastern boreal forest. Auk 120, 505–511.

Raphael, M. G. and M. White. 1984. Use of snags by cavity-nesting birds in the Sierra Nevada. Wildlife Monographs 86:1-66.

Raphael, M.G., M.L. Morrison, and M.P. Yoder-Williams. 1987. Breeding bird populations during twenty-five years of postfire succession in the Sierra Nevada. Condor 89:614-626.

Saab, V. A. and J. G. Dudley. 1998. Responses of cavity-nesting birds to stand-replacement fore and salvage logging in ponderosa pine/Douglas-fir forests of southwestern Idaho. USDA Forest Service Rocky Mountains Research Station Research Paper RMRS-RP-11, Ogden, ID.

Saab, V. A., H.D.W. Powell, N.B. Kotliar, and K.R. Newlon. 2005. Variation in fire regimes of the Rocky Mountains: implications for avian communities and fire management. Studies in Avian Biology 30: 76-96.)

Saab, V. A., R. E. Russell, and J. Dudley. 2007. Nest densities of cavity-nesting birds in relation to post-fire salvage logging and time since wildfire. Condor 109:97-108.

Saab, V.A., R.E. Russell, J.G. Dudley. 2009. Nest-site selection by cavity-nesting birds in relation to postfire salvage logging. Forest Ecology and Management 257: 151-159.

Scott, V.E., et al. 1977. Cavity-nesting birds of North American forests. Forest Service, Agriculture Handbook 511, Washington, D.C. 112 p.

Tremblay, J. A., J. Ibarzabal, C. Dussault, and J.-P. L. Savard. 2009. Habitat requirements of breeding Black-backed Woodpeckers (*Picoides arcticus*) in managed, unburned boreal forest. *Avian Conservation and Ecology - Écologie et conservation des oiseaux* **4**(1): 2. [online] URL: http://www.ace-eco.org/vol4/iss1/art2/

Villard, P. and C. W. Benniger. 1993. Foraging behavior of male Black-backed and Hairy woodpeckers in a forest burn. Journal of Field Ornithology 64(1):71-76.

Wisdom, M.J., R.S. Holthausen, B.C. Wales, [and others]. 2000. Source habitats for terrestrial vertebrates of focus in the Interior Columbia Basin: broad-scale trends and management implications. USDA Forest Service, PNW-GTR-485.

Wisdom, M. J. and L. J. Bate. 2008. Snag density varies with intensity of timber harvest and human access. Forest Ecology and Management 255:2085–2093.

LEWIS'S WOODPECKER (*Melanerpes lewis*) MODEL APPLICATION AND ASSESSMENT RESULTS

Introduction

Lewis's woodpecker was chosen as a focal species for the Post-fire Group to represent post-fire habitat with lower densities of large snags and trees present as compared to other species in the group that prefer post-fire habitat with a high density of fire-killed trees. This species was selected as a focal species because it is closely tied to post-fire habitats, it is widespread across the western United States and it occurs in suitable habitat across the planning area. This woodpecker is also associated with unburned ponderosa pine forests with open canopies and large trees as well as cottonwood/willow habitat. However, it generally is at lower abundance in these habitats than in post-fire habitat.

Source Habitat Description

Lewis's woodpeckers breed in wooded areas with an open canopy, often with a dense shrub cover, and generally avoid dense forest. Three main habitats used throughout its range are burned or logged areas, open ponderosa pine savanna at high elevations, and riparian woodland dominated by large cottonwoods at low elevations (Tobalske 1997, Saab and Dudley 1998, Saab and Vierling 2001, Bock 1970, Abele et al. 2004). Suitability of burned areas as habitat for Lewis's woodpeckers may vary with size of burn, time since burn, intensity of burn, and geographic region (Tobalske 1997, Saab and Dudley 1998, Saab and Vierling 2001, Russell et al. 2007). Recent research by Russell et al. 2007 found that the best predictors of nest location for Lewis's woodpeckers after a wildfire in Idaho were burn severity, patch area, and snag diameter. In a Wyoming study, nests were preferentially located within or adjacent to burned ponderosa pine forests, and in sites with greater ground cover, more downed logs, and greater amount of open sky than random sites (Linder and Anderson 1998). Linder and Anderson (1998) found that use was declining in an area that burned 20 years earlier.

Optimal canopy closure for nest sites was <= 30% (Linder and Anderson 1998; Sousa 1983). Some studies have suggested that Lewis's woodpeckers require a shrubby understory (e.g., Bock 1970; Sousa 1983), while others have shown that preferred habitat included a relatively sparse shrub layer (<18%; Block and Brennan 1987, Linder and Anderson 1998). In winter this species occupies a variety of habitat types that offer proximity to mast, fruit, or corn. Typically these are oak woodlands or orchards. In portions of the Southwest, this species may winter in areas without mast (Bock 1970).

Saab and Vierling (2001) found that some cottonwood riparian forests primarily near agricultural development, may be acting as sink habitat. More research on the productivity of Lewis's woodpeckers in different habitat types is needed.

We identified both primary and secondary source habitat for the Lewis's woodpecker.

We identified primary source habitat as:

- Post-fire moderate and high severity burns 2001-2007
  - pre-fire habitats were pine cover-type and trees >21" dbh
  - potential vegetation types xp, dp, dd, dg
- Post-fire habitat 1988-2000 in potential vegetation types xp, dp, dd, dg

We identified secondary source habitat as:

- Potential vegetation types: xp, dp
- Tree size: >=21" dbh
- Canopy closure: <40%
- Single-story
- National Wetlands Inventory: Palustrine Forested Wetlands
- FS potential vegetation : riparian forest

- Ecological systems data: riparian forest types

Snag Habitat

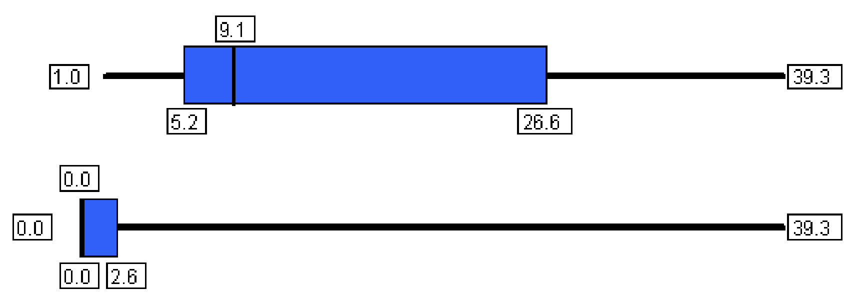
Unlike other woodpeckers, Lewis's woodpecker is not morphologically well-adapted to excavate cavities in hard wood (Spring 1965). Lewis's woodpeckers tend to nest in a natural cavity, re-use pre-existing cavities, or may excavate a new cavity in a soft snag (Harrison 1979, Raphael and White 1984, Tobalske 1997, Saab and Dudley 1998). Mated pairs may return to the same nest site in successive years. On partially-logged burns with high nesting densities in Idaho, nest sites were characterized by the presence of large, soft snags and an average of 62 snags per hectare with > 23 centimeter dbh (Saab and Dudley 1998). Galen (1989) in eastern Oregon found that in unburned ponderosa pine/Oregon white oak habitat the mean dbh of nest trees was 26 in. (66cm) with a range of 12.5 – 43 in (31.8-109 cm). Haggard and Gaines (2001) in northeast Washington found Lewis's woodpeckers in post fire habitat were more abundant in areas with <12 snags (>=25cm dbh) per hectare and were not found in areas with >=37 snags per hectare following salvage logging of the burn. Saab et al. (2009) also found Lewis's woodpecker's nests sites were primarily associated with partially logged burns.

In primary habitat (post-fire) we assumed snag density was adequate for this species. In secondary habitat we calculated the percentage of source habitat within each watershed that had densities of snags >50 cm dbh in the following classes based on data from Decaid data (Mellen-Mclean et al. 2009):

Potential Vegetation: xp, dp, dd

Low	0
Mod	0-1/ha
High	1-2.6/ha
Very high	>=2.6/ha

Figure PPDF_L.inv-3. 30%, 50%, and 80% tolerance levels, and range of densities (#/ha) of snags ≥ 50.0 cm dbh on unharvested inventory plots (n=14) that contained measurable snags (upper figure) and all unharvested inventory plots (n=70) (lower figure) in the Ponderosa Pine/Douglas-fir Forest, Larger Trees Vegetation Condition.



Road Density

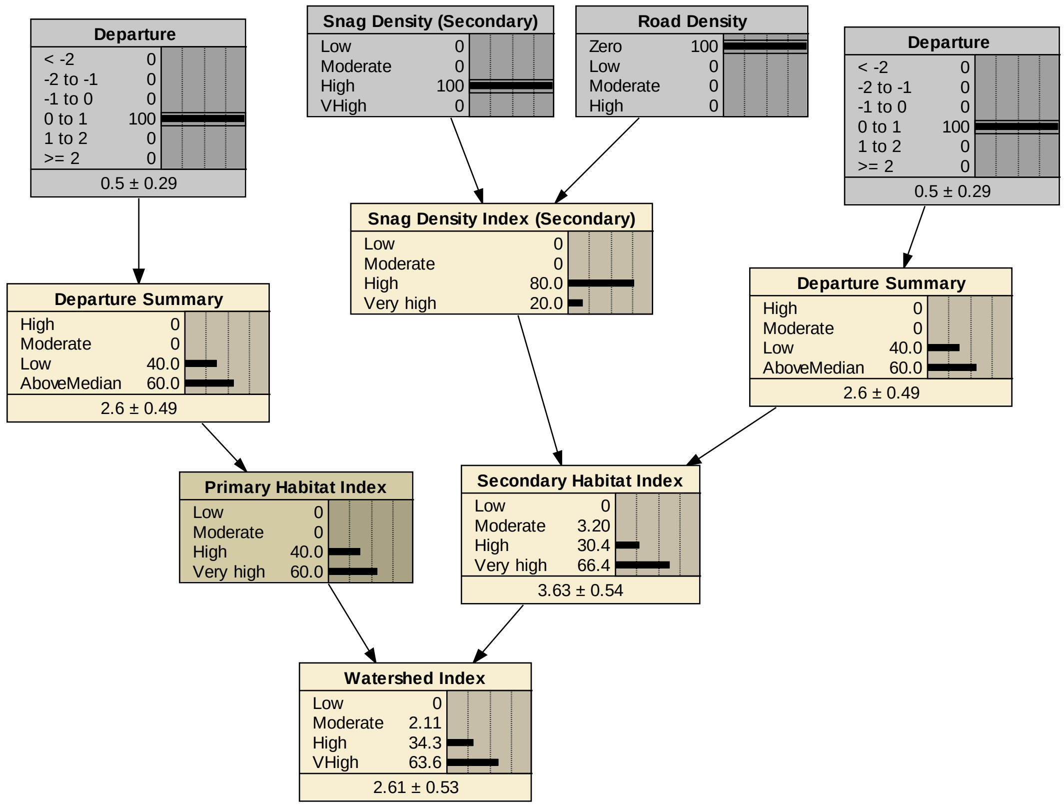
Bate et al. (2007), found that snag numbers were lower adjacent to roads due to safety considerations, firewood cutters, and other management activities. Other literature has also found reduced snag abundance along roads (Wisdom and Bate 2008). To account for reduced snag density along roads, we calculated the percent of forests in the dry potential vegetation types in the following road density classes by watershed:

Zero - <0.06 km/km2 open roads in watershed (<0.1 mi/mi2)
Low - 0.06-0.62 km/km2 open roads in watershed (0.1-1.0 mi/mi2)
Moderate - 0.63-1.24 km/km2 open roads in watershed (1.1-2.0 mi/mi2)
High - >1.24 km/km2 open roads in watershed (>2.0 mi/mi2)

Historical Inputs for Focal Species Assessment Model

Departure of primary source habitat - Class 1
Departure of secondary source habitat – Class 1
Secondary habitat snag density – Low 30%; Moderate 20%, High 30%, Very High 20%
Road density - Zero

Lewis's Woodpecker Focal Species Assessment Model



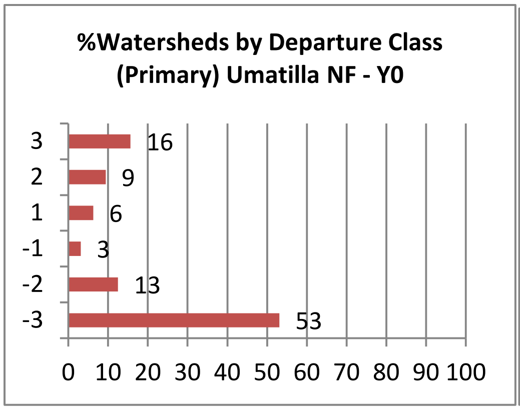
Figure—Focal species assessment model for Lewis's woodpecker

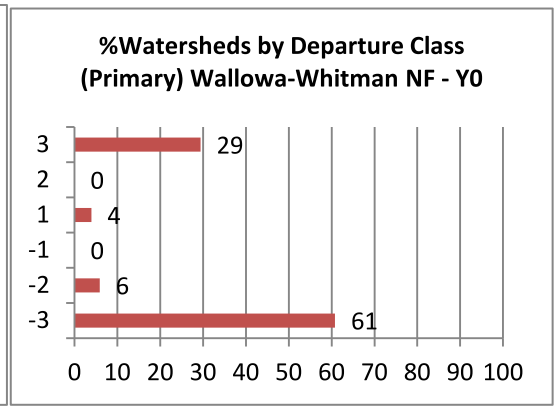
Table -- Relative sensitivity of Watershed Index values to variables in the model for Lewis's woodpecker

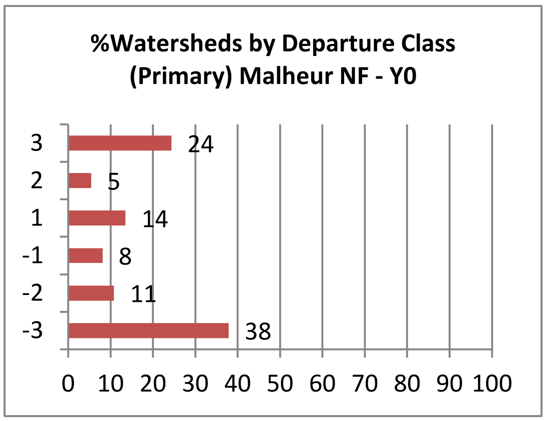
Variable	Sensitivity rank
Primary habitat departure	1
Secondary habitat departure	2
Snag density	3
Road density	4

Assessment Results

Watershed Index Scores







Although at the Forest level, primary habitat (post-fire) was above the historical median, overall on a watershed level, most watersheds were below the historical median

In addition to the large reduction in primary source habitat, the amount of secondary source habitat is also far below the historical median. Most secondary habitat that was identified was riparian habitat, as there is little open pine habitat with >21" trees in the very dry types (xp, dp).

Secondary	% watersheds departure class		
Habitat	Umatilla	Wallowa-Whitman	Malheur
-3	69	90	100
-2	3	0	0
-1	28	10	0
1	0	0	0
2	0	0	0
3	0	0	0

		Snag Density		Road Density
	# Water-sheds	Low/Moderate	High/Vhigh	>=50% Moderate/High
UMA	32	47% (n=15)	53% (n=17)	100%
WAW	51	55% (n=28)	45% (n=23)	100%
MAL	37	100%	0%	100%
Blue Mtns	115	66% (n=76)	34% (n=39)	100%

*snag densities- % of watersheds with >=50% of the source habitat in the different snag classes

**road densities - % of watersheds with >50% of potential habitat in the different road density classes

Viability Outcome

Currently the viability outcome is primarily about a C on all 3 Forests. Historically the outcome was primarily an A, indicating habitats were broadly distributed and in high abundance.

Viability Outcome	Umatilla NF		Wallowa-Whitman NF		Malheur NF	
	Historical	Current	Historical	Current	Historical	Current
HisWWI/CurWWI	100	42		48		23
%Hucs >=40%	74	35	67	41	51	35
Clusters	3/3	3/3	4/4	4/4	3/3	3/3
A	80	0	75	0	70	0
B	14	15	18	21	21	0
C	5	63	6	71	8	46
D	1	22	1	8	2	44
E	0	0	0	0	0	10

Figure – Historical and Current Viability Outcome Lewis's Woodpecker

The main factors leading to a lower current viability outcome compared to the estimated historical outcome was the loss of open canopied large pine tree habitat (secondary habitat) as well as the lower abundance and distribution of post-fire habitats.

Under historical conditions, Lewis's woodpecker and other species associated with the Post-fire Group were likely well-distributed across the planning area. Currently, we estimated that both the abundance (at a watershed level) and distribution of suitable environments for these species has declined and led to poorer outcomes.

Alternative B – Viability Analysis

Input Variables:
Primary Habitat – PVG: xp, dp, dd, dg, post-fire
Secondary Habitat – PVG: xp, dp, >=21" dbh, open-canopied, riparian cottonwoods
Snag density – in secondary habitat
Road density – in potential secondary habitat

We did not run the Viability Model for Lewis's woodpecker for Alternative B. Modeling primary habitat (post-fire) through VDDT a non-spatial vegetation model is problematic and likely does not capture well the uncertainty surrounding wildfire occurrence and our ability to suppress all fires. The discrepancy between Year 0 and Year 20 in the abundance of post-fire habitat is because the data came from 2 completely different data-sets. For Year 0 we used actual known fire data from as far back as 1988, while Alternative B Year 20 data came from a modeled data set.

Instead of running the focal species assessment models, we will qualitatively look at trends in both primary and secondary habitat to evaluate how the viability for Lewis's woodpecker may change under Alternative B. At both the watershed and Forest level, both the amount of primary and secondary habitat show high habitat departure (class -3) for both the Year 20 and Year 50 time periods in all watersheds (see tables below). Although fire will likely occur, because of fire suppression and a continued low abundance of 'large tree/open canopied pine habitat' (secondary habitat), likely viability will remain very low for Lewis's Woodpecker under alternative B across the 3 National Forests for some time to come. However, the amount of secondary habitat does show an increasing trend through Year 20 and Year 50 VDDT output modeling.

Plan components of Alternative B that address post-fire habitat, and protection of snags and large tree habitat should benefit this species. Some of these components are listed in the table below:

WLD-HAB-11 G-11	**Guideline** To the extent practical, known cavity or nest trees should be preserved when conducting prescribed burning activities, mechanical fuel treatments, and silvicultural treatments.
WLD-HAB-13 S-7	**Standard** Where management activities occur within dry or cool moist forest habitat, all snags 21 inches DBH and greater and 50 percent of the snags from 12 to 21 inches DBH shall be retained, except for the removal of danger/hazard trees. Snags shall be retained in patches.
WLD-HAB-16	**Guideline**

G-4	Greater than 50 percent of post-fire source habitat should be retained and should not be salvage logged.
WLD-HAB-17 G-5	**Standard** Salvage logging shall not occur within burned source habitat areas less than 100 acres, except for the removal of danger/hazard trees.
WLD-HAB-18 G-6	**Guideline** Where salvage logging occurs, all snags 21 inches DBH and greater and 50 percent of the snags from 12 to 21 inches DBH should be retained except for the removal of danger/hazard trees. Snags should be retained in patches.
OF-1 G-59	**Guideline** Management activities in old forest stands should retain live old forest trees (≥ 21 inches DBH). Exceptions include: • old forest tree(s) need to be removed to favor hardwood species, such as aspen or cottonwood, or other special habitats • old forest late seral species, such as grand fir, are competing with large diameter early seral species, such as ponderosa pine • old forest tree(s) need to be removed to reduce danger/hazard trees along roads and in developed sites • a limited amount of old forest trees need to be removed where strategically critical to reinforce and improve effectiveness of fuel reduction in WUIs
OF-2 G-60	**Guideline** Management activities in non-old forest stands should retain live legacy old forest trees (≥ 21 inches DBH). Exceptions to retaining live legacy old forest trees are the same as those noted in the previous guideline (OF-1).
OF-3	**Guideline** New motor vehicle routes should not be constructed within old forest stands.

Habitat Trends by Forest Alternative B:

		Historical Median	Current	Y20	Y50
Common Name		UMA	UMA	UMA	UMA
Lewis's Woodpecker					
	Potential_acresPRI		637,924	647,789	647,789
	S.Habitat_acres1		58,902	9,958	11,991
	%Potential_PRI	4	9	2	2
	Potential_acresSEC		137,927	155,489	155,489
	S.Habitat_acres2		2,852	5,631	15,713
	%Potential_SEC	51	2	4	10

		Historical Median	Current	Y20	Y50

Common Name		WAW	WAW	WAW	WAW
Lewis's Woodpecker					
	Potential_acresPRI		839,957	841,708	841,708
	S.Habitat_acres1		91,380	12,780	16,823
	%Potential_PRI	4	11	2	2
	Potential_acresSEC		187,929	198,408	198,408
	S.Habitat_acres2		8,583	4,520	11,627
	%Potential_SEC	55	5	2	6

		Historical Median	Current	Y20	Y50
Common Name		MAL	MAL	MAL	MAL
Lewis's Woodpecker					
	Potential_acresPRI		1,166,668	1,248,760	1,248,760
	S.Habitat_acres1		94,552	22,899	23,977
	%Potential_PRI	3	8	2	2
	Potential_acresSEC		463,708	559,533	559,533
	S.Habitat_acres2		7,844	20,015	42,724
	%Potential_SEC	54	2	4	8

Literature cited:

Abele, S.C., V.A. Saab, and E.O. Garton. (2004, June 29). Lewis's Woodpecker (*Melanerpes lewis*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/lewisswoodpecker.pdf [date of access].

Bate, L. J., Wisdom, M. J., Wales, B. C. 2007. Snag densities in relation to human access and associated management factors in forests of Northeastern Oregon, USA. Landscape and Urban Planning 80. pp 278-291.

Block, W. M.; Brennan, L. A. 1987. Characteristics of Lewis's woodpecker on the Modoc Plateau, California. Western Birds. 18: 209-212.

Bock, C. E. 1970. The ecology and behavior of the Lewis' woodpecker (Asyndesmus lewis). University of California Publications in Zoology. 92: 1-100.

Galen, C. 1989. A preliminary assessment of the status of Lewis' woodpecker in Waso County, Oregon. Oreg. Dept. of Fish and Wildl. Tech. Rep. 88-3-01. Portland, OR.

Gentry, D.J, Vierling, K.T. 2007. Old burns as source habitats for Lewis's Woodpeckers breeding in the black hills of South Dakota. The Condor 109(1):122-131.

Haggard, Maryellen, and William L. Gaines. 2001. Effects of stand-replacement fire and salvage logging on a cavity-nesting bird community in eastern Cascades, Washington. NW Science. 75(4):387-396.

Harrison, H. H. 1979. A field guide to western birds' nests. Houghton Mifflin Company, Boston. 279 pp.

Linder, K. A.; Anderson, S. H. 1998. Nesting habitat of Lewis' woodpeckers in southeastern Wyoming. Journal of Field Ornithology. 69: 109-116.

Mellen-McLean, Kim, Bruce G. Marcot, Janet L. Ohmann, Karen Waddell, Susan A. Livingston, Elizabeth A. Willhite, Bruce B. Hostetler, Catherine Ogden, and Tina Dreisbach. 2009. DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 2.1. USDA Forest Service, Pacific Northwest Region and Pacific Northwest Research Station; USDI Fish and Wildlife Service, Oregon State Office; Portland, Oregon. http://www.fs.fed.us/r6/nr/wildlife/decaid/index.shtml

Raphael, M.G. and M. White. 1984. Use of snags by cavity-nesting birds in the Sierra Nevada. Wildlife Monograph 86:1-66.

Russell, R.E., Saab, V.A, Dudley, J.G. 2007. Habitat-suitability models for cavity-nesting birds in a postfire landscape. Jrnl Wildl Manage 71(8):2600-2611.

Saab, V.A. and J.G. Dudley. 1998. Reponses of cavity-nesting birds to stand-replacement fire and salvage logging in ponderosa pine/Douglas-fir forests of southwestern Idaho. USDA Forest Service Research Paper, RMRS-RP-11.

Saab, V.A. and K.T. Vierling. 2001. Reproductive success of Lewis's woodpecker in burned pine and cottonwood riparian forests. Condor 103:491-501.

Saab, V.A., R.E. Russell, J.G. Dudley. 2009. Nest-site selection by cavity-nesting birds in relation to postfire salvage logging. Forest Ecology and Management 257: 151-159.

Sousa, Patrick J. 1983. Habitat Suitability Index models: Lewis's Woodpecker. FWS/OBS-82/10.32. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 14pp.

Spring, L.W. 1965. Climbing and pecking adaptations in some North American woodpeckers. Condor 67:457-488.

Tobalske, B. W. 1997. Lewis's woodpecker (Melanerpes lewis). No. 284. In: Poole, A.; Gill, F., eds. The Birds of North America. Philadelphia, PA: The Birds of North America, Inc.

Wisdom, M.J., R.S. Holthausen, B.C. Wales, C.D. Hargis, V.A. Saab, D.C. Lee, W.J. Hann, T.D. Rich, M.M. Rowland, W.J. Murphy, and M.R. Eames. 2000. Source habitats for terrestrial vertebrates of focus in the Interior Columbia Basin: broad-scale trends and management implications. Pages 157-434 *in* T.M. Quigley, editor. Interior Columbia Basin Ecosystem Management Project: Scientific Assessment. USDA Forest Service GTR PNW-GTR-485. Pacific Northwest Research Station, Portland, OR.

Wisdom, M. J. and L. J. Bate. 2008. Snag density varies with intensity of timber harvest and human access. Forest Ecology and Management 255:2085–2093.

PEREGRINE FALCON (*Falco peregrinus)* MODEL APPLICATION AND ASSESSMENT OF RESULTS

Introduction

The peregrine falcon was selected as a focal species for the Habitat/Generalist/Cliff Group because of their association with large cliff habitats as compared to the other species in the group (gray wolf, grizzly bear and wolverine). Suitable nesting habitat occurs on all three national forests though habitat on the Malheur NF is very limited. The number of available nest sites may have changed little from what was available historically in eastern Washington (Hayes and Buchanan 2002) we suspect the same is true for eastern Oregon.

Model Variables

Source Habitat

The presence of prominent cliffs is the most common habitat characteristics of peregrine falcon nesting territories (Hays and Milner 1999, Hayes and Buchanan 2002). Prominent cliffs function as both nesting and perching sites, and provide unobstructed views of the surrounding landscape (Ratcliffe 1993, Hayes and Buchanan 2002). Nest site suitability requires the presence of ledges that are essentially inaccessible to mammalian predators, that provide protection from the elements, and that are dry (Campbell et al. 1990, Johnsgard 1990). A source of water, such as a river, lake, marsh or marine waters, is typically in close proximity to the nest site and likely is associated with an adequate prey base of small to medium sized birds (Cade 1982, Johnsgard 1990).

On average, peregrine falcon eyeries were about 200 feet (60 meters) from a fresh water source in Washington (Hayes and Buchanan 2002). This study reported only a few sites more than 1000 feet (305 meters) from a creek or a body of water >3 acres (1.2 ha) in size (Hayes and Buchanan 2002).

To model the availability of source habitat for the peregrine falcon, we used a digital elevation model to identify cliff structures that were ≥5 acres in size. This allowed us to distinguish the prominent cliffs structures from the smaller cliffs that were unlikely to provide nesting habitat.

We set the current departure at the historical median and assumed nesting habitat has not changed in abundance since historical.

Habitat Quality Factors

Nesting Habitat Amount

We used the amount of source habitat present within a watershed as a measure of the quality of the habitat quality for the watershed. To do this we overlayed the watersheds onto the source habitat maps and determined the amount of source habitat in the watershed on USFS lands. We then categorized the amount of source habitat as follows:

Zero = <10 acres of source habitat

Low source habitat = >10 acres but < the median (110 ac) of source habitat across

all watersheds

High source habitat = > the median (110 ac) of source habitat across all watersheds

Foraging Habitat Amount

We also assessed the amount of foraging habitat within each watershed. Foraging habitat was defined as any water-body $\geq$ 1.2 ha (3 acres) (Hayes and Buchanan 2002). We did not assess the proximity off nesting and foraging habitat as described in Hayes and Buchanan (2002) because we assumed each watershed was small enough and peregrine falcons mobile enough that they could forage anywhere in the watershed. We used the following categories to assess the amount of foraging habitat on ALL lands for each watershed:

Low = <10 acres of foraging habitat

Moderate = 10 acres to median (168 acres) across all watersheds

High = > median (168 acres) of all watersheds

Habitat Effectiveness

Human activities have been documented to cause disturbance to nesting peregrine falcons (Windsor 1975, Lanier and Joseph 1989, Holthuijzen et al. 1990). Several authors have recommended 800 meters buffers on nest sites to reduce the potential effects of human disturbances on nesting peregrine falcons (Richardson and Miller 1997, Hays and Milner 1999). We assessed the potential for human disturbance to affect nesting habitat using the peregrine falcon nesting habitat disturbance index described in Gaines et al. (2003). We mapped 800 meter buffers on each side of open roads and trails to delineate zones of influence and then overlaid this with our map of source habitat. We used the following categories to assess the potential affects of human disturbance on peregrine falcon habitat effectiveness on USFS lands for each watershed:

Low habitat effectiveness = <25% of the source habitat outside a zone of influence

Moderate habitat effectiveness = 25-50% of the source habitat outside a zone of influence

High habitat effectiveness = >50% of the source habitat outside a zone of influence

Historical Inputs for Focal Species Assessment Model

Source Habitat – Class 1
Nesting Habitat Amount – same as current
Foraging Habitat Amount – same as current
Habitat Effectiveness - High

Relative Sensitivity of Model to Variables

Table -- Relative sensitivity of watershed index values to variables in the model for the peregrine falcon

Model Variables	Order of Variable Weighting
Source habitat	**1**
Nesting habitat amount	**2**
Foraging habitat amount	**3**
Habitat effectiveness	**4**

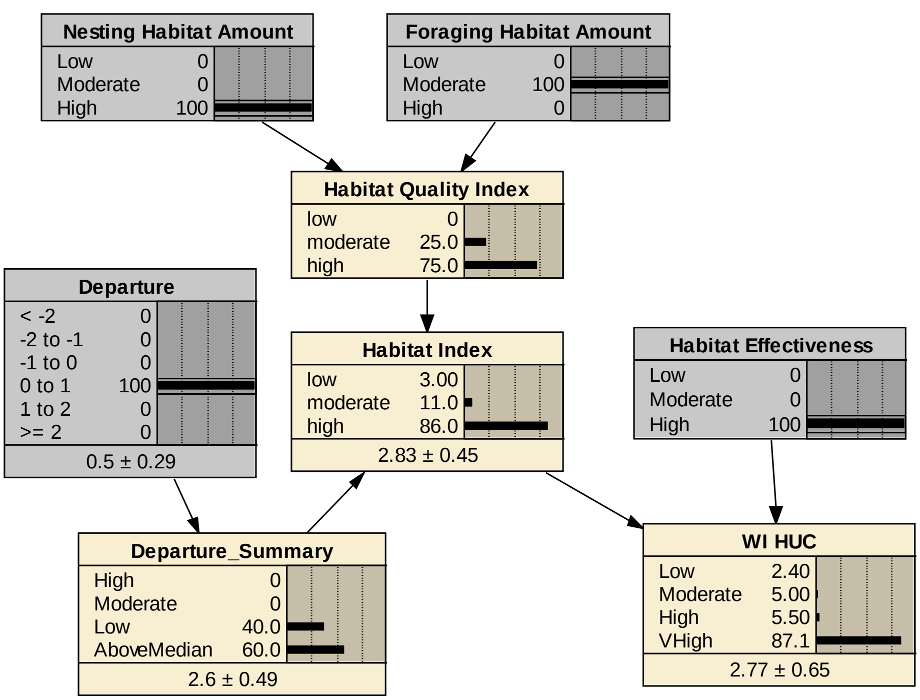


Figure – Focal species assessment model for the peregrine falcon

Assessment Results

Because there was so little overall nesting habitat (<70 ha) on the Malheur NF, we did not analyze viability for that national forest.

Current Watershed Index Scores

We included watersheds that had some nesting habitat on USFS lands though we include foraging habitat from all lands.

		Watershed Index - Current		
	# Watersheds	Low	Moderate	High
UMA	16	6% (n=1)	50% (n=8)	44% (n=7)
WAW	26	19% (n=5)	42% (n=11)	38% (n=10)

		Nesting Habitat			Foraging Habitat			Habitat Effectiveness		
	# Water-sheds	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
UMA	16	6% (n=1)	31% (n=5)	63% (n=10)	6% (n=1)	44% (n=7)	50% (n=8)	56% (n=9)	31% (n=5)	13% (n=2)
WAW	26	19% (n=5)	31% (n=8)	50% (n=13)	0%	38% (n=10)	62% (n=16)	62% (n=16)	23% (n=6)	15% (n=4)

Because we did not assume that there was any departure in the amount of nesting habitat from historical, changes in WI from historical was related to changes in habitat effectiveness from historical.

Viability Outcome	Umatilla NF		Wallowa-Whitman NF	
	Historical	Current	Historical	Current
HisWWI/CurWWI	100	87	100	90
%Hucs >=40%	63	63	50	50
Clusters	2/3	2/3	3/4(moderate)	3/4(moderate)

A	0	0	0	0
B	55	45	53	43
C	36	40	37	40
D	10	16	10	17
E	0	0	0	0

Umatilla NF:

The VO model incorporated the weighted WI (WWI) scores (described earlier), and a habitat distribution index. The weighted watershed index scores indicated that the current habitat capability across the planning area was about 89% of the historical capability. This largely had to do with the effects of human activities in source habitat for peregrine falcons. Currently, 63% of the watersheds had source habitat amounts that were >40% of the historical median. Habitat both currently and historically was located across 2 of the 3 clusters, we considered this distribution as 'Moderate'. Habitat for this species is moderately distributed across the range of the species on the Umatilla NF.

Wallowa-Whitman NF:

The weighted watershed index scores indicated that the current habitat capability across the planning area was about 90% of the historical capability. This largely had to do with the effects of human activities in source habitat for peregrine falcons. Currently, 50% of the watersheds had source habitat amounts that were >40% of the historical median, and these watersheds were distributed across 3 of the 4 clusters (moderate).

Malheur NF:

We did not evaluate viability through this modeling process on the Malheur NF. Habitat for the peregrine falcon on the Malheur NF is very limited (<200 acres), and we did not feel it appropriate to use this modeling process. We identified limited nesting habitat on USFS lands in 7 watersheds on the Malheur NF.

Alternative B Analysis

Assessment inputs:

Source habitat – cliff structures ≥5 acres in size
Nesting habitat amount – rock – no change
Foraging habitat amount - water-body ≥ 1.2 ha (3 acres)
Habitat effectiveness - % of the source habitat outside a zone of influence (800 meter buffers on each side of open roads and trails)

The only variable in the Watershed Index model that may change in any of the action alternatives is habitat effectiveness. This variable was modeled in the current condition by quantifying the amount of source habitat within 800m of an open road or trail. Because the alternatives are not as site specific as to identify any specific future road or trail changes (spatially), we are unable to run the watershed index model on any particular outcome at any particular time period.

It is possible that if any new roads or trails are developed within source habitat, habitat effectiveness might decline, and if roads or trails are closed, habitat effectiveness might increase. Higher habitat effectiveness may lead to better/higher viability outcomes, and lower habitat effectiveness may lead to lower viability outcomes.

Plan components in each alternative give us some indication of potential changes that may have an effect on viability for this species.

Alternative B – There is little indication from this alternative that extensive road building will occur. Several plan components stress the need to reduce road densities or have no net increase in road densities especially in key watersheds. A standard is also in place that protects nesting areas.

KW-1 S-15	**Standard** There shall be no net increase in the mileage of Forest Roads in any key watershed unless the increase results in a reduction in road-related risk to watershed condition. Priority should be given to roads that pose the greatest relative ecological risks to riparian and aquatic ecosystems.
OF-3 *New*	**Guideline** New motor vehicle routes should not be constructed within old forest stands.
WLD-HAB-28 G-14	**Guideline** Roads and trails should not be constructed within high elevation riparian areas.
WLD-HAB-6 S-1	**Standard** Activities that have potential to cause abandonment or destruction of known denning, nesting, or roosting sites of threatened, endangered, or sensitive species shall not be authorized or allowed within 1,200 feet of those sites.

In Summary: Much of the source habitat is located within or in close proximity to both key watersheds and RMA's, based on the desired conditions, objectives and standards and guidelines the risk to peregrine falcon viability is not increasing. Likely due to implementation of Alternative B, viability will remain the same as current or increase due to the plan components that may lead to increased habitat effectiveness.

REFERENCES

Cade, T.J. 1982. The falcons of the world. Cornell University Press, Ithaca, New York.

Campbell, N.K., I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 1990. The birds of British Columbia. University of British Columbia Press, British Columbia, Canada.

Gaines, W.L., P.H. Singleton, and R.C. Ross. 2003. Assessing the cumulative effects of linear recreation routes on wildlife habitats on the Okanogan and Wenatchee National Forests. USDA Forest Service, Pacific Northwest Research Station, PNW-GTR-586.

Hayes, G.E., and J.B. Buchanan. 2001. Washington State status report for the peregrine falcon – draft. Washington Department of Fish and Wildlife, Olympia, Washington.

Hays, D.W., and R.L. Milner. 1999. Peregrine falcon, *Falco peregrinus*. Pages 11-1 to 11-4 in Management recommendations for Washington's Priority Species. Volume IV: Birds. Washington Department of Fish and Wildlife, Olympia, Washington.

Holthuijzen, A.M.A., W.G. Eastland, A.R. Ansell, M.N. Kochert, R.D. Williams, and L.S. Young. 1990. Effects of blasting on behavior and productivity of nesting prairie falcons. Wildlife Society Bulletin 18: 270-281.

Johnsgard, P.A. 1990. Hawks, eagles, and falcons of North America: biology and natural history. Smithsonian Institution.

Lanier, J.W., and R.A. Joseph. 1989. Managing human recreational impacts on hacked or free-ranging peregrines. Pages 149-153 in B.A.G. Pendleton, editor. Proceedings of the western raptor management symposium and workshop. National Wildlife Federation Scientific and Technical Series No. 12.

Ratcliffe, D.A. 1993. The peregrine falcon. Second edition. T&A D Poyser, London, England.

Richardson, C.T., and C.K. Miller. 1997. Recommendations for protecting raptors from human disturbance: a review. Wildlife Society Bulletin 25: 634-638.

Windsor, J. 1975. The response of peregrine falcons to aircraft and human disturbance. Canadian Wildlife Service Note 87.

WOLVERINE *(Gulo gulo)* MODEL APPLICATION AND ASSESSMENT RESULTS

Introduction

The wolverine was selected as a focal species for the Habitat Generalist Group. It is sensitive to risk factors that can cause disturbance (Gaines et al. 2003, Copeland et al. 2007, Krebs et al. 2007) as are the other species in this group. Reports of wolverines within the assessment area have been steadily increasing since the 1960s (Johnson 1977, Edelmann and Copeland 1999, Aubry et al. 2007). Currently, their distribution appears to include the Cascades, Kettle Range and Selkirk Mountains, though their density is likely low (Edelmann and Copeland 1999, Aubry et al. 2007). In the winter of 2011, wolverine presence was documented (e.g. photos) in the Eagle Cap Wilderness area of the Wallowa-Whitman NF.

Model Variables

Source Habitat

Montane coniferous forests, suitable for winter foraging and summer kit rearing, may only be useful if connected with subalpine cirque habitats required for natal denning, security areas, and summer foraging (Copeland 1996). Similar to other large mammalian carnivores in the Rocky Mountains (e.g., *Ursus arctos*, *Canis lupus*), the current distribution of wolverines may be more determined by intensity of human settlement than by biophysical factors such as vegetation type or topography (Kelsall 1981, Banci 1994, Carroll et al. 2001).

Several researchers have documented the effects of roads on wolverines and their habitat and have included roads in models of source habitat (Wisdom et al. 2000, Carroll et al. 2001, Raphael et al. 2001, Rowland et al. 2003, Copeland et al. 2007, Krebs et al. 2007). Carroll et al. (2001) found areas with road densities <1mile/mile^2 to be a strongly correlated with the presence of wolverine. Rowland et al. (2003) in a test of the Raphael et al (2001) model, found that road density was a better predictor than habitat amount of wolverine abundance when applied at the watershed scale (such as our Watershed Index model). Thus, we incorporated road densities into our definition of source habitat. To identify source habitat for this species, we limited the analysis of current source habitat to those areas with road densities of <1mi/square mile. We included most cover types and structural stages in montane forest, subalpine forest, alpine tundra, as did Wisdom et al. (2000), and Raphael et al. (2001).

We used the following variables to identify wolverine source habitat within the assessment area:

- Potential Vegetation: cm, cd, sw, also all non ‘dry’ upland shrub, grass, or riparian as indicated by the forests’ PVG layer

- Road density: areas with road densities <1 mile/mile^2

- Elevation >=4000 ft (1,219 m)

To calculate current departure we calculated the amount of potential habitat, regardless of road density; this equaled our estimated historic amount of source habitat. We assumed a 30% loss of habitat per departure class. (<30% loss = Departure class -1, 30-60% loss = Departure class -2, >60% loss = Departure Class -3).

Mean Patch Size

Banci (1994) identified the need for large areas of the appropriate vegetation types and with low human use to provide for the conservation of wolverine. We evaluated the relative size of the areas of source habitat within a watershed by computing a mean patch size and classified the data into 3 classes, representing high, medium, and low. Our assumption was that the greater the mean patch size the more conservation value the watershed would have for wolverine. We categorized the mean patch size within a watershed of all patches >=1ha as follows:

- Low mean patch size = <5km^2
- Moderate mean patch size = 5-10 km^2
- High mean patch size = >10 km^2

Potential Den Habitat

Natal dens are typically above or near treeline, require snow depths of 1-3 m that persist into spring, and are in close proximity to rocky areas such as talus slopes or boulder fields (Copeland 1996). The predictive habitat model for wolverine developed by Carroll et al. (2001) was improved when alpine cirque habitat was added as a variable as a surrogate to denning habitat. We modeled potential den habitat as glacial cirques and valleys from the land type association coverage. The amount of potential wolverine den habitat was categorized as follows:

- **Zero = 0 ha of potential den habitat**
- **Low = >0 – 1500 ha of potential den habitat**
- **Moderate = >1500 – 3500 ha of potential den habitat**
- **High = >3500 ha of potential den habitat**

Winter Habitat Effectiveness

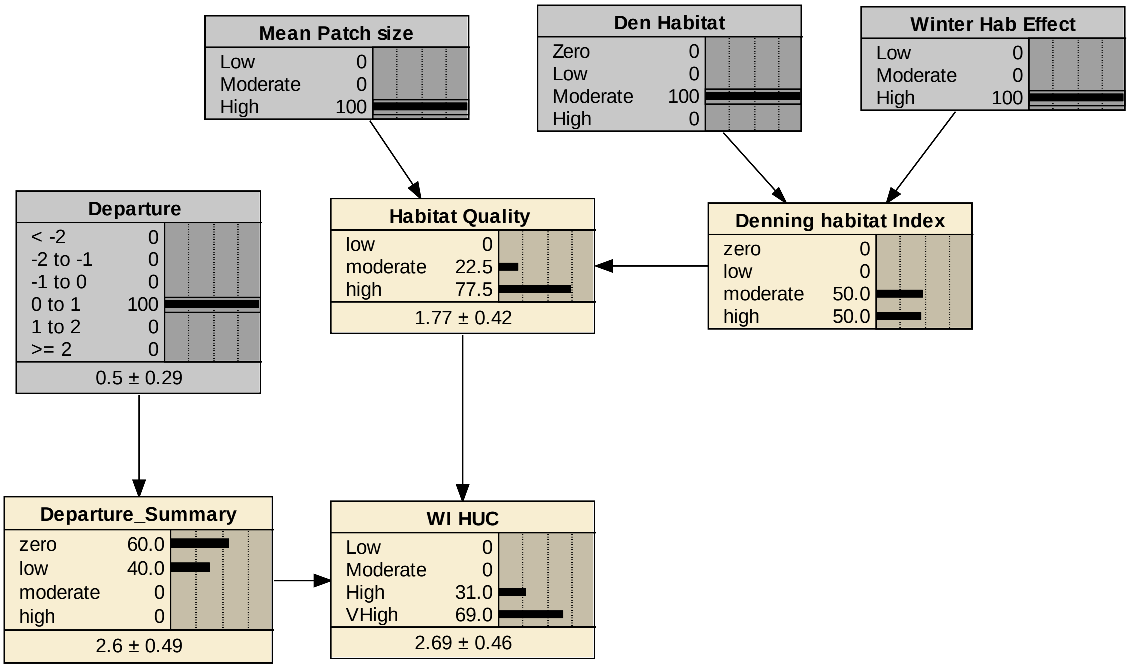
Copeland (1996) documented the potential for disturbance to wolverine natal dens as a result of late-winter to spring snowmobile and other winter recreation activities. We assessed the potential effects of winter recreation on the effectiveness of wolverine habitat by overlaying designated winter routes onto wolverine habitat and calculating the density of these routes. This was an under-estimate of the impacts of winter activities as other groomed and designated routes were present in the assessment area but not in our digital inventory. We categorized the effects of winter recreation activities on wolverine habitat as follows:

- Low habitat effectiveness = >25% of habitat with winter route densities >2mi./mi.^{2}
- Moderate habitat effectiveness = >25% of habitat with winter route densities >1mi./mi.^{2}
- High habitat effectiveness = <25% of habitat with winter route densities >1mi./mi.^{2}

Historical Inputs for Focal Species Assessment Model
Source Habitat – cm, cd, sw also all upland wetland, upland grass, upland shrub, riparian, and other additional potential vegetation types that were not dry (or non-forest) above 4,000' elevation.
Patch Size – High
Den Habitat – same as current (though in both current and historical the Node A calculation, divided the total WWI by the total HIS WWI using 'High' denning)
Winter Habitat Effectiveness - High

Relative Sensitivity of Model to Variables

Model Variables	Order of Variable Weighting
Source Habitat	**1**
Patch Size	**2**
Den Habitat	**3**
Winter Habitat Effectiveness	**4**



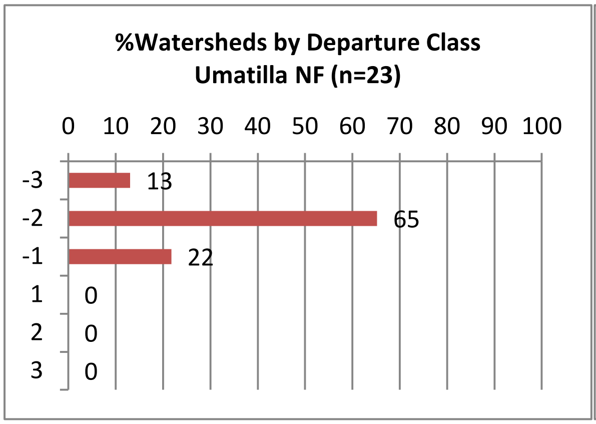
Figure–Focal species assessment model for the wolverine

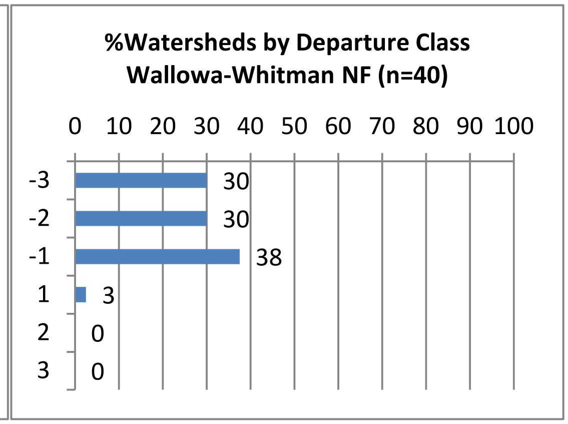
Assessment Results

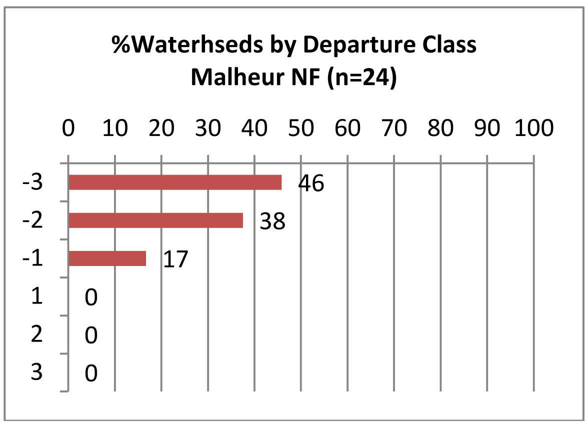
Watershed Index Scores

WI scores on all 3 forests currently were primarily in the Low class (<1.0). The lower scores were largely due to the influence of roads on the loss of source habitat for wolverines. In our model, roads reduced the availability of source habitat. Areas with high road densities have been shown to have lower probabilities of wolverine occurrence (Caroll et al. 2001, Rowland et al. 2003). All of the watersheds with High (>2.0) WI scores occurred within the Wallowa-Whitman national forest planning area and are largely a result of the presence of wilderness and roadless areas.

Habitat departure was measured by the area in each watershed with a road density of <1 mi/mi2. On the Malheur NF, nearly half of all watersheds currently are in the -3 departure class.







Patch size of source habitat currently was predominantly low currently

Other factors that influenced the WI scores included the availability of alpine cirques used for denning habitat (Copeland 1996). Only on the Wallowa Whitman were there any watersheds with a high abundance of potential denning habitat (n=4,10%). Watersheds with the greatest amount of potential denning habitat are all in the Wallowa Mountains include: Eagle Creek, Upper Wallowa Creek, Upper Imnaha River, and the Minam River.

Currently, the influence of groomed and designated winter recreation routes have little affect on the potential wolverine denning habitat that we modeled. However, there are winter recreation routes that are not designated or groomed that may influence denning habitat.

		Patch Size			Winter Habitat Effectiveness			Denning Habitat			
	# hucs	Low	Moderate	High	Low	Moderate	High	Zero	Low	Moderate	High
UMA	23	100 (n=23)	0	0	13 (n=3)	0	87 (n=20)	87 (n=20)	9 (n=2)	4 (n=1)	0
WAW	40	85 (n=34)	15 (n=6)	0	0	8 (n=3)	93 (n=37)	58 (n=23)	15 (n=6)	18 (n=7)	10 (n=4)

MAL	24	100 (n=24)	0	0	0	0	100 (n=24)	75 (n=18)	21 (n=5)	4 (n=1)	0

Table- Percentage of watersheds by planning area by attribute value

Viability Outcome Scores

	Historical	Current	Historical	Current	Historical	Current
	Umatilla	Umatilla	WaW	WaW	Mal	Mal
S.Habitat Acres		374,597		663,823		136,483
% of Historical		64		66		44
Node A	77	31	88	39	80	18
%40	78	61	75	53	92	46
#Clusters	3/3	3/3	4/4	3/4(high)	3/3	2/3
A	10	0	70	0	82	0
B	74	0	21	0	14	0
C	12	47	8	36	4	0
D	4	49	1	54	1	25
E	0	5	0	10	0	75

Because wolverines are highly mobile, we evaluated the contribution of dispersal habitat in the viability outcome model (see Part 1, page 12). We used methods similar to Singleton et al (2002) to measure habitat permeability. Currently, the overall permeability of the planning area for wolverine was rated overall as moderate to high; likely wolverine mobility is not restricted.

Current permeability				
	Uma	Waw	Mal	Blues
Low	0	1	0	1
Moderate	18	37	34	31
High	82	62	65	69
Historical permeability				
	Uma	Waw	Mal	Blues
Low	0	0	0	0

Moderate	15	28	16	21
High	85	71	84	79

The current Viability Outcomes (VO) vary across the 3 Forests though lower than historical. The lower outcome on the Malheur NF is attributed to the lower distribution score, as habitat above the 40% threshold now only occurs in 2 of 3 clusters.

Historically, the VO for wolverine was most likely “A” or “B” where suitable environments were more broadly distributed or of high abundance. In addition, the suitable environments were better connected, allowing for interspecific interactions. Our analysis indicated that a reduction in the availability of suitable environments for the wolverine, and likely other species in the Human Disturbance Group, occurred in the planning area compared to the historical distribution and condition of their habitats.

Alternative B Analysis

Assessment inputs:

Source Habitat – area of cm, cd, sw also all upland wetland, upland grass, upland shrub, riparian, and other additional potential vegetation types that were not dry (or non-forest) above 4,000’ elevation with <1 mile/sq. mile open road density.
Patch Size – of source habitat
Den Habitat – glacial cirques and valleys
Winter Habitat Effectiveness - % of habitat with different winter route densities

The variables in the Watershed Index model that may change in any of the action alternatives are open road densities, patch size and winter habitat effectiveness.

Because the alternatives are not as site specific as to identify any specific future road or trail changes (spatially), we are unable to run the watershed index model on any particular outcome at any particular time period.

Plan components in each alternative give us some indication of potential changes that may have an effect on viability for this species.

It is possible in Alternative B that if any new roads or trails (including winter trails) are developed, the amount of source habitat, patch size and winter habitat effectiveness might decline and lead to a lower viability outcome. Additionally if road and/or trail densities decrease the amount of source habitat, patch size and winter habitat effectiveness could increase and ultimately lead to increase in viability

Alternative B – There is little indication from this alternative that extensive road building will occur. Several plan components stress the need to reduce road densities or have no net increase in road densities especially in key watersheds.

All alternatives incorporate plan components which prohibits management activities near denning sites; however it is unlikely that management actions would occur in the area and during the time of denning. With the exception of the no action alternative (A) all alternatives have more acres allocated to management areas that would have the least amount of human disturbance.

KW-1 S-15	**Standard** There shall be no net increase in the mileage of Forest Roads in any key watershed unless the increase results in a reduction in road-related risk to watershed condition. Priority should be given to roads that pose the greatest relative ecological risks to riparian and aquatic ecosystems.
OF-3 *New*	**Guideline** New motor vehicle routes should not be constructed within old forest stands.
WLD-HAB-28 G-14	**Guideline** Roads and trails should not be constructed within high elevation riparian areas.
WLD-HAB-6 S-1	**Standard** Activities that have potential to cause abandonment or destruction of known denning, nesting, or roosting sites of threatened, endangered, or sensitive species shall not be authorized or allowed within 1,200 feet of those sites.

Summary: Likely due to implementation of Alternative B, viability will remain the same as current. Any reduction in road densities especially adjacent to known locations/territories of wolverines should benefit this species.

Literature Cited

Aubry, K. B., K. S. McKelvey, and J. P. Copeland. 2007. Distribution and broadscale habitat relations of the wolverine in the contiguous United States. Journal of Wildlife Management 71:2147–2158.

Banci, V. 1994. Wolverine. Pages 99-127 in USDA Forest Service, GTR-RM-254.

Carroll, C., R.F. Noss, and P.C. Paquet. 2001. Carnivores as focal species for conservation planning in the Rocky Mountain Region. Ecological Applications 11:961-980.

Copeland, J.P. 1996. Biology of the wolverine in central Idaho. MS Thesis, University of Idaho, Moscow, ID. 138pp.

Copeland, J. P., J. M. Peek, C. R. Groves, W. E. Melquist, G. W. Mcdaniel, C. D. Long, and C. E. Harris. 2007. Seasonal habitat associations of wolverines in Idaho. Journal of Wildlife Management 71:2201–2212.

Edelmann, F., and J. Copeland. 1999. Wolverine distribution in the northwestern United States and a survey in the Seven Devils Mountains of Idaho. Northwest Science 73:295-300.

Gaines, W.L., P.H. Singleton and R.C. Ross. 2003. Assessing the cumulative effects of linear recreation routes on wildlife habitats on the Okanogan and Wenatchee national forests. PNW-GTR-586.

Johnson, R.E. 1977. An historical analysis of wolverine abundance and distribution in Washington. The Murrelet 58:13-16.

Kelsall, J. P. 1981. COSEWIC status report on the wolverine Gulo gulo, in Canada. Ottawa, Ontario - Committee on the Status of Endangered Wildlife in Canada. 50 pp.

Krebs, J. A. and D. Lewis. 2000. Wolverine ecology and habitat use in the North Columbia Mountains: progress report. Pages 695–703. *in* Darling, L. M., editor. Proceedings of a conference on the biology and management of species and habitats at risk. Volume 2. British Columbia Ministry of Environment, Lands and Parks and University College of the Cariboo. Victoria, Canada.

Krebs, J., E. C. Lofroth, and I. Parfitt. 2007. Multiscale habitat use by wolverines in British Columbia, Canada. Journal of Wildlife Management 71:2180–2192.

Raphael, M.G., M.J. Wisdom, M.M. Rowland, R.S. Holthausen, B.C. Wales, B.G. Marcot, and T.D. Rich. 2001. Status and trends of habitats of terrestrial vertebrates in relation to management in the interior Columbia river basin. Forest Ecology and Management 5502:1-25.

Rowland, M.M., M.J. Wisdom, D.H. Johnson, B.C. Wales, J.P. Copeland, and F.B. Edelmann. 2003. Evaluation of landscape models for wolverines in the interior Northwest, United States of America. Journal of Mammalogy 84(1):92-105.

Singleton, P.H., W.L. Gaines, and J.F. Lehmkuhl. 2002. Landscape permeability for large carnivores in Washington: a geographic information system weighted-distance and least-cost corridor assessment. USDA Forest Service, PNW-RP-549.

Wisdom, M.J., R.S. Holthausen, B.C. Wales, [and others]. 2000. Source habitats for terrestrial vertebrates of focus in the Interior Columbia Basin: broad-scale trends and management implications. USDA Forest Service, PNW-GTR-485.