Monitoring the Ecological Effect of Fuels Reduction in the Ashland Watershed: A Summary of Pre-treatment Bird Community Composition

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Introduction

The Ashland Watershed, located in Southwest Oregon, spanning from the top of Mt. Ashland to Ashland Creek's confluence with Bear Creek in the town of Ashland, historically had an understory fire regime with natural burning occurring in the watershed on a 10 year fire cycle (USDA 2001). Over the last century fire suppression activities, with the exception of two large fires in 1910 and 1959, virtually kept fire out of the watershed. This has resulted in fuels build-up that could lead to a stand replacing wildfire in the watershed, uncharacteristic of the areas historic fire regime. As a result of fire suppression vegetation composition and structure within the watershed has shifted from a heterogeneous mix of opened and closed conifer and hardwood forests, to a landscape that is more homogeneous and dominated by closed conifer stands.

Fuels reduction has been identified as a necessary action to restore fire-adapted historical ecological conditions in the watershed and to reduce the threat of a wildfire burning at a severity that is uncharacteristically higher than expected within the watersheds historic fire regime. Within an adaptive management framework monitoring efforts are being established to evaluate the ecological effects of planned fuels reduction efforts in the watershed. Because bird monitoring can be used as a cost effective tool to evaluate the ecological effects of management (Alexander et al. 2007, Hutto 1998) the U.S. Forest Service and Klamath Bird Observatory established bird monitoring as part of the effectiveness monitoring efforts associated with planned fuels treatments within the watershed.

In this report we present a comprehensive list of species detected in the watershed between 2005 and 2007 during breeding season surveys, and during 2007 fall dispersal and migration surveys and constant effort mist netting efforts. We summarize an analysis of survey data that relates the existing bird community to current forest conditions within the watershed as they relate to vegetation composition and structure. We then make predictions, based on a Partners in Flight bird conservation plan (Altman 1999, Rich et al. 2004), about the response of a select group of species to the ecological changes that may result from fuels reduction efforts in the Ashland Watershed.

Methods

Bird and Habitat Monitoring

We used standardized bird and vegetation monitoring methods (Ralph et al. 1993) to survey birds in the Ashland Watershed. To measure bird abundance and distribution during the breeding season (May-June) point counts were conducted annually at 136 stations within the Ashland Watershed between 2005-2007 (Stephens and Alexander 2005, Stephens and Alexander 2006, Stephens and Alexander 2008). Vegetation composition and structure were measured at each station using the Releve' habitat assessment method. To measure abundance and distribution during the fall dispersal and migration season (September and October) we conducted 20-minute area searches at 70 stations in 2007 (Stephens and Alexander 2008). In 2007 we also began monitoring population demographics using constant effort mist netting techniques from May through October at an ecological monitoring station in the watershed (Frey and Alexander 2008).

Data Analysis

Abundance - Relative abundance (birds/station), as measured by point counts and area searches, were calculated for all survey sites combined within the Ashland Watershed. Only species detected within 50 m of survey stations were included in abundance calculations. Total captures, by season, were calculated using constant effort mist netting data. Partners in Flight focal species, which are indicative of a variety of ecosystem components, are highlighted in the results (Table 1; Altman 1999 and Rich et al. 2004).

Frequency - The frequency of occurrence for species that were present at greater than 5% of stations during the breeding and fall seasons were calculated to be used in multivariate analyses of bird community distribution within the Ashland Watershed. We combined the three years of breeding season data because there is only slight evidence of annual variation in the frequency of birds during the breeding season (Genzoli et al. 2007). For the breeding season data species were determined to be present at a station if they were detected on 1 of 3 visits.

Vegetation Indices - Vegetation data collected during 2005 or 2006 were used to calculate 2 simple vegetation indices for describing bird distribution as it relates to current habitat conditions. Following procedures outlined by Seavy (2006) a vegetation volume index that varies from 0 (low volume) to 1 (high volume) and a vegetation composition index that varies from 0 (broadleaf dominated) to 1 (conifer dominated) were calculated. Categorical variables were created in order to plot vegetation characteristics on bird community ordinations by assigning indices that fall below .5 to one category, and those falling on or above .5 to a second category.

Ordination - Non-metric multidimensional scaling (NMS, Mather 1976) was used to ordinate the bird communities in PC-ORD (McCune and Mefford 1999), using the Relative Euclidian metric. Random starting configurations were used, with 40 runs of real data and 50 runs of randomized data. Stress values quantify the ability of NMS to capture similarities of the bird community in a given number of dimensions and were used to assess the dimensionality of the data. The Monte Carlo test was used to determine whether the axes generated were stronger than those obtained by chance. Ordination plots were developed differentiating stations based on differences in their vegetation indices.

Results and Discussion

Partners in Flight (PIF) Conservation Species

Of the species detected in the Ashland Watershed during the breeding season 10 are Oregon Washington Partners in Flight coniferous forest focal species (Table 1) (Altman 1999). Two of these species were captured during the breeding season at the Ashland Watershed constant effort mist netting station. Eight of the species detected during the breeding season are identified as species of continental importance (Rich et al. 2004). Four of these species were captured during the breeding season at the mist netting station during the fall.

Of the species detected in the Ashland Watershed during the fall dispersal and migration season 4 are Oregon Washington Partners in Flight coniferous forest focal species (Table 1) (Altman 1999). Four of the species detected during the fall season are identified as species of continental importance (Rich et al. 2004), 2 of which were captured at the mist netting station during the fall.

The occurrence of a variety of PIF coniferous forest focal species in the Ashland Watershed indicates that a variety of conditions that are considered important for the conservation of coniferous forest birds occur in the watershed. For example, several species detected within the watershed represent a variety of mature forest conditions. Pileated Woodpeckers are associated with mature closed canopy forests and large snags (Altman 1999). Pacific-slope Flycatchers are associated with mature forests with deciduous trees in the canopy. Hammonds Flycatchers are associated with open sub-canopies and Hutton’s Vireos with more complex hardwood dominated sub-canopy and shrub layer (Altman 1999). Because there are a variety of coniferous forest focal species occurring in the Ashland Watershed we expect the bird community to shift, with some species benefiting and others being negatively impacted by changing vegetation structure and composition that results from fuels reduction efforts. This will allow us to measure the ecological effects of management by associated changes in vegetation structure and composition with changes in the bird community the result from fuels treatments.

Bird Community Composition (Multivariate Ordination)

One dimension was selected for the spring bird community ordination with a minimum stress value of 48, which is higher than we would like to see for a clear interpretation. However, the Monte Carlo value of 0.02 indicated that the NMS extracted stronger axis than expected by chance. Two dimensions were selected for the fall bird community ordination with a minimum stress value of 25, which is also higher than we would like to see for a clear interpretation. Again, the Monte Carlo value of 0.04 indicated that the NMS extracted stronger axis than expected by chance. The ordination of survey stations based on species occurrence frequency during the breeding season showed very little separation for both the vegetation volume (Figure 1) and the vegetation composition (Figure 2) indices. Similarly, the ordination based on species occurrence frequency during the fall dispersal and migration season showed little separation for the vegetation volume and vegetation composition indices (Figure 3, Figure 4). This indicates that these vegetation variables do not explain much of the variation within the bird community, based on this base-line pre-treatment dataset.

Among the 11 most abundant species detected during the breeding season in the Ashland Watershed (Table 1), 5 were found to be associated with high volume conifer forests (Golden-crowned Kinglet, Brown Creeper, Hermit Warbler, Pacific-slope Flycatcher, Winter Wren) and 2 with conifer dominated forests (Red-breasted Nuthatch, Yellow-rumped Warbler) in a study in the Little Applegate Valley, which is adjacent to the Ashland Watershed (Figure 5) (Seavy 2006). This suggests that the Ashland Watershed is dominated by high volume conifer dominated forests. Because the watershed is not characterized by the larger spectrum of mixed conifer hardwood habitats, as represented by vegetation volume and vegetation composition indices (Figure 5), there is relatively little variation in the bird community based on these variables, as indicated by the ordinations.

Fire suppression in the Ashland Watershed has likely resulted in the homogeneous occurrence of high volume conifer dominated forests across the landscape. In the Little Applegate Valley wildfire resulted in an immediate reduction in vegetation volume, followed by a gradual increase in the contribution of broadleaf vegetation relative to conifer vegetation (Seavy 2006). Because fire is spatially heterogeneous, it results in a landscape with greater variation with regards to vegetation volume and composition, as demonstrated in the Little Applegate Valley. Fuels reduction efforts in the Ashland Watershed that are intended to mimic the effects of wildfire should have a similar effect, increasing the heterogeneity of habitat characteristics, as described by vegetation volume and composition. Post treatment bird surveys will therefore be more likely to result in a greater variation in the bird community as described by vegetation structure and composition.

Predicted Response to Fuels Reduction

Based on peer published literature and expert opinion we made predictions regarding the near and mid-term response of 13 Partners in Flight focal species for Oregon coniferous forest (Altman 1999) and species of continental importance (Rich et al. 2004) that were detected in the Ashland Watershed (Table 2). Five species are predicted to decrease in the near and mid-term as a result of fuels reduction treatments. The Hermit Warbler and Pacific-slope Flycatcher are associated with well developed forest canopies and are predicted to decrease as a result of reduced canopy cover resulting from fuels treatments.

The Winter Wren and Hutton's Vireo are associated with understory vegetation and are predicted to decrease as a result of reduced sub-canopy and shrub vegetation.

Two species are predicted to increase in the near and mid-term as a result of fuels reductions treatments (Table 2). The Hammond's Flycatcher is associated with an open sub-canopy and is predicted to increase as a result of reduced complexity in the forest canopy. The Olive-sided Flycatcher, associated with residual canopy trees is predicted to increase as a result of leaving larger trees in more open habitats where fuels treatments occur.

We expect many of the species that are predicted to initially respond negatively to fuels treatments to benefit over the long-term. Species that are associated with mature forests, such as Hermit Warbler and Pileated Woodpecker should benefit from fuels treatments that are designed to ultimately enhance old-growth characteristics. Species associated with a deciduous component in mixed conifer hardwood habitats, such as Pacific-slope Flycatcher and Hutton's Vireo, should benefit as broad-leaf vegetation re-sprouts and becomes a more significant component of the forest after fuels treatments.

Acknowledgements

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Tables and Figures

Table 1. Species detected between 2005 and 2007 during Klamath Bird Observatory bird monitoring. Spring relative abundance (bird per station) from point counts (n=408) surveyed annually between 2005 and 2007 and fall relative abundance from 2007 fall area searches (n=70). Species captured at the Klamath Bird Observatory Ashland Watershed constant effort station May-October 2007 by breeding and fall migration seasons. [Breeding = 27 May-21 August; Fall Migration = 4 September-9 October]. Focal species of the Partners in Flight Conservation Strategy for Landbirds in Coniferous Forests (Altman 1999) and Partners in Flight Species of Continental Importance (Rich et al. 2004) are indicated.

Table 2. Predicted near and mid-term response of Partners in Flight coniferous forest focal species for Oregon and species of continental importance to fuels reduction in the Ashland Watershed based on published literature (Seavy 2006, Rich et al. 2004, Marshall et al. 2003, Alexander 1999, Altman 1999) and expert opinion.

Figure 1. NMS ordination of breeding bird community with the conifer broadleaf index indicated. An index of less then 50% broadleaf is plotted in green and greater then 50% broadleaf is plotted in red. The blue “+” indicates where a species falls within the ordination space.

Figure 2. NMS ordination of breeding bird community with the relative vegetation volume index indicated. An index of less then 50% relative vegetation volume is plotted in red and greater then 50% relative vegetation volume is plotted in green. The blue “+” indicates where a species falls within the ordination space.

Figure 3. NMS ordination of fall bird community with the conifer broadleaf index indicated. An index of less then 50% broadleaf is plotted in green and greater then 50% broadleaf is plotted in red. The blue “+” indicates where a species falls within the ordination space.

Figure 4. NMS ordination of fall bird community with the relative vegetation volume index indicated. An index of less then 50% relative vegetation volume is plotted in red and greater then 50% relative vegetation volume is plotted in green. The blue “+” indicates where a species falls within the ordination space.

Figure 5. A conceptual design of the distribution of forest characteristics as described by vegetation volume and vegetation composition indices, along with bird species associated with habitats in the Little Applegate Valley, derived from results from Seavy (2006).

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Table 1.

	Survey Counts		Mist Netting	
	Point Counts	Area Search	Captures	
Species Common and Scientific Name	Breeding	Fall Migration	Breeding	Fall Migration
American Goldfinch (*Carduelis tristis*)		0.2462		
American Robin (*Turdus migratorius*)	0.0200	0.1077	3	0
Anna's Hummingbird (*Calypte anna*)	0.0022			
Black-capped Chickadee (*Poecile atricapilla*)	0.0111		0	1
Blue-gray Gnatcatcher (*Polioptila caerulea*)	0.0044			
Brown-headed Cowbird (*Molothrus ater*)	0.0022			
Black-headed Grosbeak (*Pheucticus melanocephalus*)	0.0956		5	0
Brown Creeper (*Certhia americana*) [1]	0.1289	0.4308		
Band-tailed Pigeon (*Columba fasciata*) [1,2]	0.0222	0.0154		
Black-throated Gray Warbler (*Dendroica nigrescens*) [2]	0.0533		0	1
Bushtit (*Psaltriparus minimus*)	0.0067			
Cassin's Finch (*Carpodacus cassinii*)	0.0022			
Cassin's Vireo (*Vireo cassinii*)	0.0156	0.0154		
Chestnut-backed Chickadee (*Poecile rufescens*) [2]	0.1800	1.4615	1	6
Cedar Waxwing (*Bombycilla cedrorum*)	0.0044			
Chipping Sparrow (*Spizella passerina*)	0.0111			
Common Raven (*Corvus corax*)	0.0089			
Dark-eyed Junco (*Junco hyemalis*)	0.3667	0.2154	112	65
Downy Woodpecker (*Picoides pubescens*)	0.0044		1	1
Dusky Flycatcher (*Empidonax oberholseri*)	0.0067		5	0
Evening Grosbeak (*Coccothraustes vespertinus*)	0.0022			
Fox Sparrow (*Passerella iliaca*)			0	3
Golden-crowned Kinglet (*Regulus satrapa*)	0.2978	1.8308	6	1
Golden-crowned Sparrow (*Zonotrichia atricapilla*) [2]			0	5
Gray Flycatcher (*Empidonax wrightii*)			1	0
Gray Jay (*Perisoreus canadensis*)	0.0022	0.0923		
Hammonds Flycatcher (*Empidonax hammondii*) [1]	0.2111		2	0
Hairy Woodpecker (*Picoides villosus*)	0.0289	0.0308		
Hermit Thrush (*Catharus guttatus*)	0.0556	0.1385	19	22
Hermit Warbler (*Dendroica occidentalis*) [1,2]	1.0533		23	2
House Wren (*Troglodytes aedon*)	0.0156			
Hutton's Vireo (*Vireo huttoni*) [1]	0.0267			
Lazuli Bunting (*Passerina amoena*)	0.0067		3	0
Lesser Goldfinch (*Carduelis psaltria*)	0.0111	0.0308		
MacGillivray's Warbler (*Oporornis tolmiei*)	0.0711		20	1
Mountain Chickadee (*Poecile gambeli*)	0.0267	0.2154	8	10
Mourning Dove (*Zenaida macroura*)	0.0022			
Mountain Quail (*Oreortyx pictus*)	0.0022			
Nashville Warbler (*Vermivora ruficapilla*)	0.1756		58	0
Northern Flicker (*Colaptes auratus*)	0.0089	0.0308		
Northern Goshawk (*Accipiter gentilis*)	0.0022			
Northern Pygmy-Owl (*Glaucidium gnoma*)		0.0154		
Orange-crowned Warbler (*Vermivora celata*)			4	3
Olive-sided Flycatcher (*Contopus cooperi*) [1]	0.0022			
Pine Siskin (*Carduelis pinus*)	0.0733	0.0923		
Pileated Woodpecker (*Dryocopus pileatus*) [1]	0.0089	0.0154		
Pacific-slope Flycatcher (*Empidonax difficilis*) [1,2]	0.3978			
Purple Finch (*Carpodacus purpureus*)	0.0178		7	2
Pygmy Nuthatch (*Sitta pygmaea*)		0.0154		
Red-breasted Nuthatch (*Sitta canadensis*)	0.1578	0.6923	10	1

Table 1 Continued.

	Survey Counts		Mist Netting Captures	
	Point Counts	Area Search		
Species Common and Scientific Name	Breeding	Fall Migration	Breeding	Fall Migration
Red-breasted Sapsucker (*Sphyrapicus ruber*) [2]	0.0244		5	0
Red Crossbill (Loxia curvirostra) [1]	0.0022			
Red-tailed Hawk (*Buteo jamaicensis*)	0.0044			
Ruffed Grouse (*Bonasa umbellus*)	0.0044	0.0154		
Ruby-crowned Kinglet (*Regulus calendula*)			0	1
Rufous Hummingbird (*Selasphorus rufus*)	0.0067		16	0
Spotted Towhee (*Pipilo maculatus*)	0.0133			
Stellers Jay (*Cyanocitta stelleri*) [2]	0.0511	0.2308	1	1
Swainson's Thrush (*Catharus ustulatus*)			2	5
Townsend's Solitaire (*Myadestes townsendi*)	0.0156			
Townsend's Warbler (*Dendroica townsendi*)	0.0022		0	2
Varied Thrush (*Ixoreus naevius*)		0.0615		
Vaux's Swift (*Chaetura vauxi*)	0.0044			
Warbling Vireo (*Vireo gilvus*)	0.0178		16	2
Western Flycatcher (*Empidonax sp*)			1	1
White-breasted Nuthatch (*Sitta carolinensis*)	0.0022			
Western Tanager (*Piranga ludoviciana*)	0.0467		12	6
Willow Flycatcher (*Empidonax traillii*) [2]			2	0
Wilson's Warbler (*Wilsonia pusilla*)	0.0111		10	1
Winter Wren (*Troglodytes troglodytes*) [1,2]	0.2044	0.3385		
Yellow-rumped Warbler (*Dendroica coronata*)	0.2067	0.4462	6	34

[1] Focal species of the Partners In Flight Conservation Strategy for Landbirds in Coniferous Forests of Western Oregon and Washington (Altman 1999)

[2] Species of Continental Importance in the Pacific Avifaunal Biome from the Partners In Flight North American Conservation Plan (Rich et al. 2004)

Table 2.

Species Common Name	OR/WA PIF Coniferous Focal Species[1] Forest Condition	Habitat Attribute	Importance[2] Primary Habitat	Response to Fuels Reduction
Hermit Warbler	Mature/Young	Canopy closure	Coniferous Forest	Decrease
Pacific-slope Flycatcher	Mature and Young	Deciduous canopy trees	Mixed Forest	Decrease
Winter Wren	Mature and Young	Forest floor complexity	Coniferous Forest	Decrease
Hammonds Flycatcher	Mature and Young	Open sub-canopy		Increase
Brown Creeper	Old-growth and Mature	Large trees		None
Chestnut-backed Chickadee			Coniferous Forest	None
Pileated Woodpecker	Mature	Large snags		None
Stellers Jay			Coniferous Forest	None
Huttons Vireo	Pole	Deciduous sub-canopy/understory		Decrease
Red-breasted Sapsucker			Mixed Forest	Unknown
Band-tailed Pigeon	Unique	Mineral springs	Mixed Forest	Decrease
Olive-sided Flycatcher	Early seral	Residual canopy trees	Coniferous Forest	Increase
Red Crossbill	Old-growth and Mature	Conifer cones		Unknown

[1] Focal species of the Partners in Flight Conservation Strategy for Landbirds in Coniferous Forests of Western Oregon and Washington (Altman 1999)
[2] Species of Continental Importance in the Pacific Avifaunal Biome from the Partners in Flight North American Conservation Plan (Rich et al. 2004)

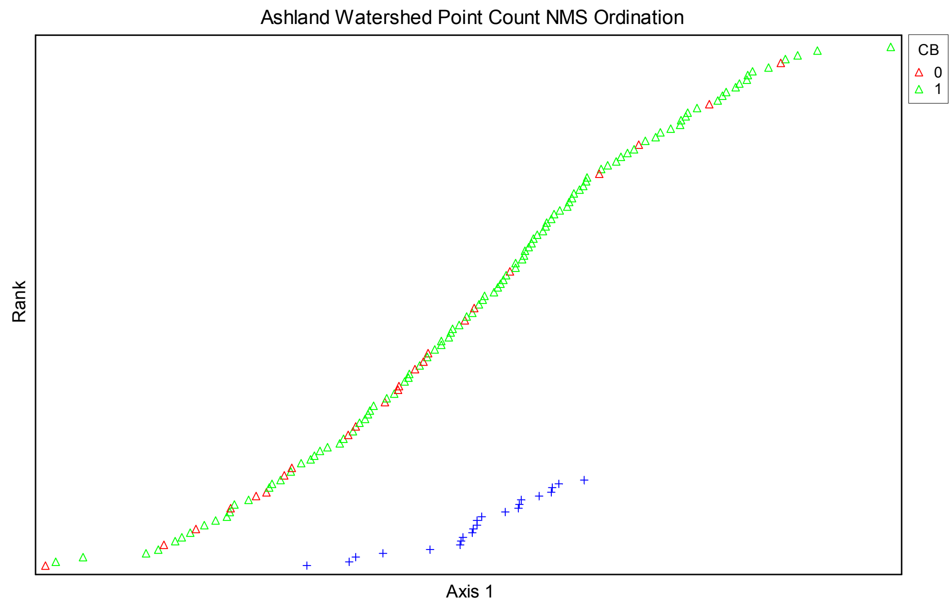
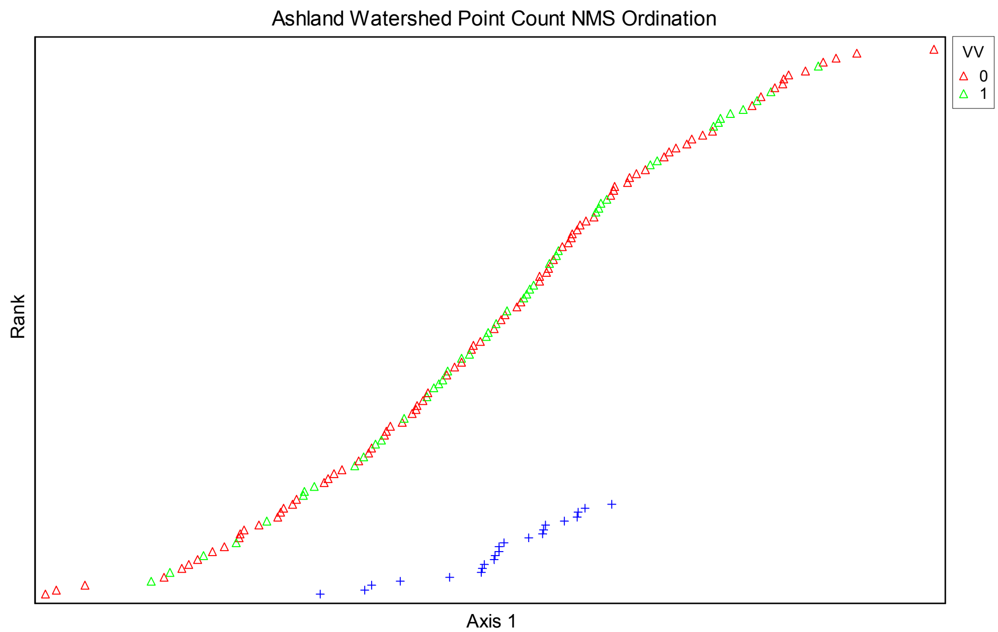


Figure 1.



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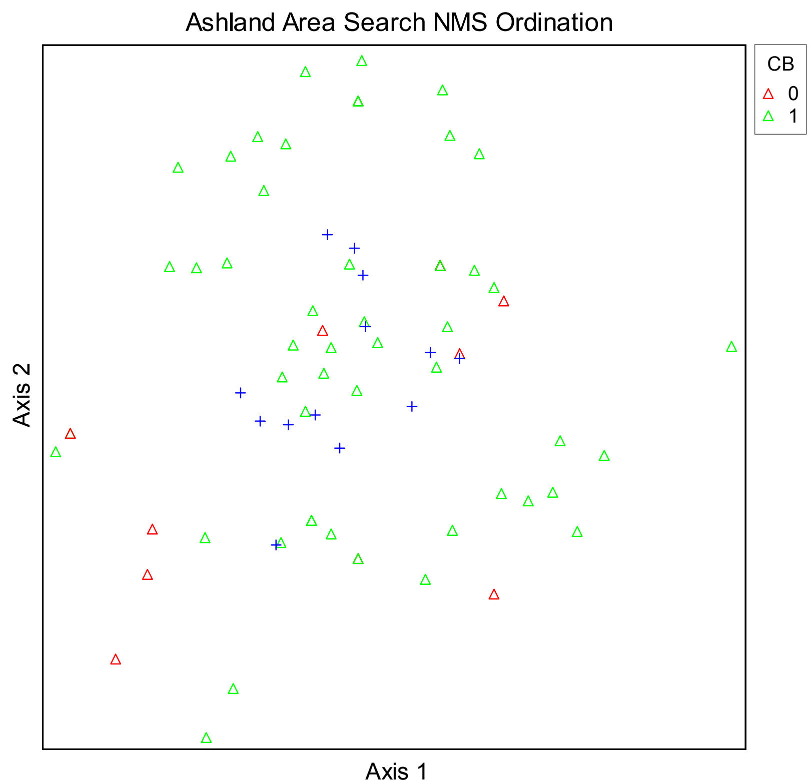

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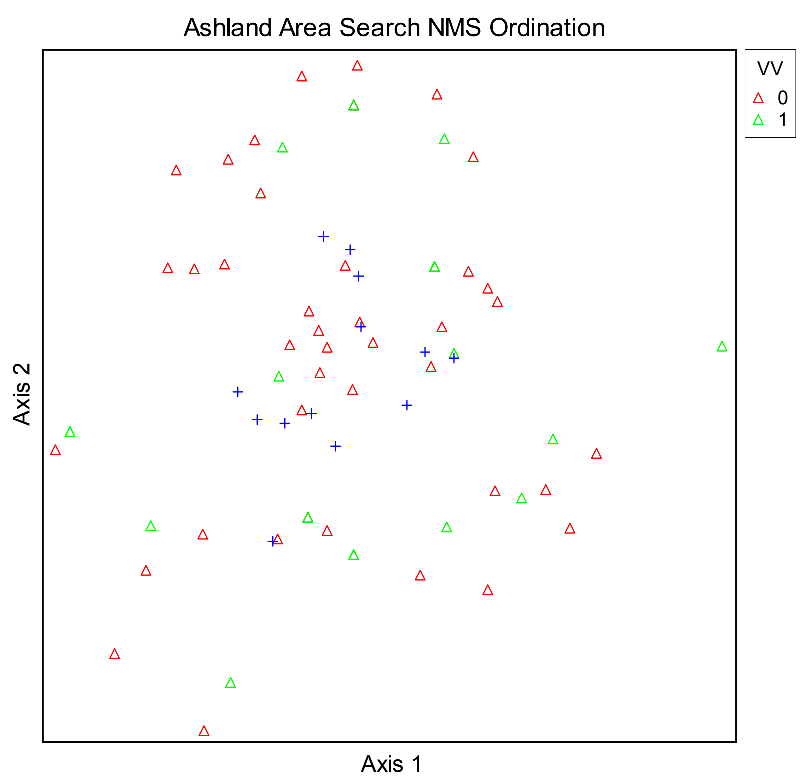

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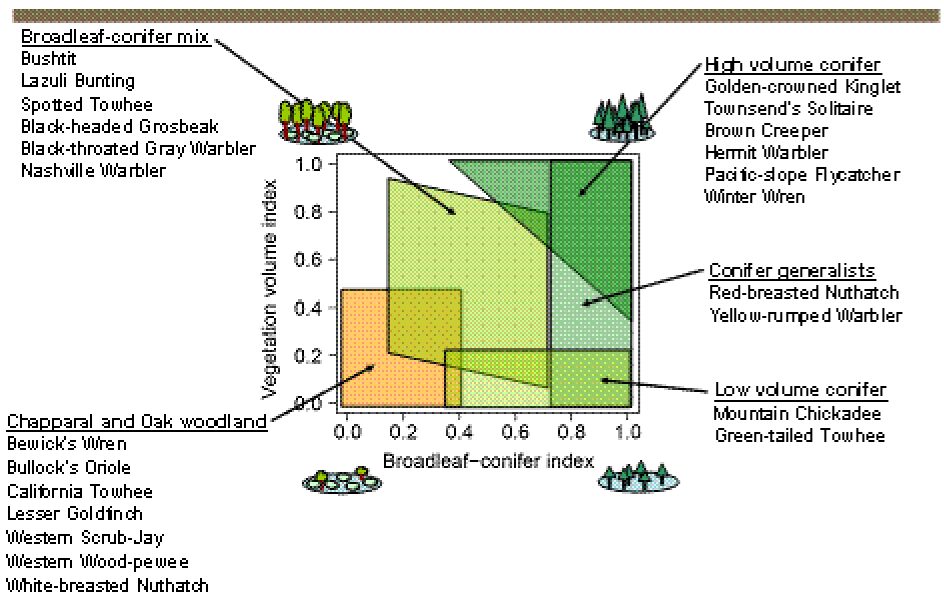
Broadleaf-conifer mix
Bushtit
Lazuli Bunting
Spotted Towhee
Black-headed Grosbeak
Black-throated Gray Warbler
Nashville Warbler
High volume conifer
Golden-crowned Kinglet
Townsend's Solitaire
Brown Creeper
Hermit Warbler
Pacific-slope Flycatcher
Winter Wren
Conifer generalists
Red-breasted Nuthatch
Yellow-rumped Warbler
Low volume conifer
Mountain Chickadee
Green-tailed Towhee
Chapparal and Oak woodland
Bewick's Wren
Bullock's Oriole
California Towhee
Lesser Goldfinch
Western Scrub-Jay
Western Wood-pewee
White-breasted Nuthatch
Vegetation volume index
Broadleaf−conifer index
0.0
0.2
0.4
0.6
0.8
1.0

Figure 5.